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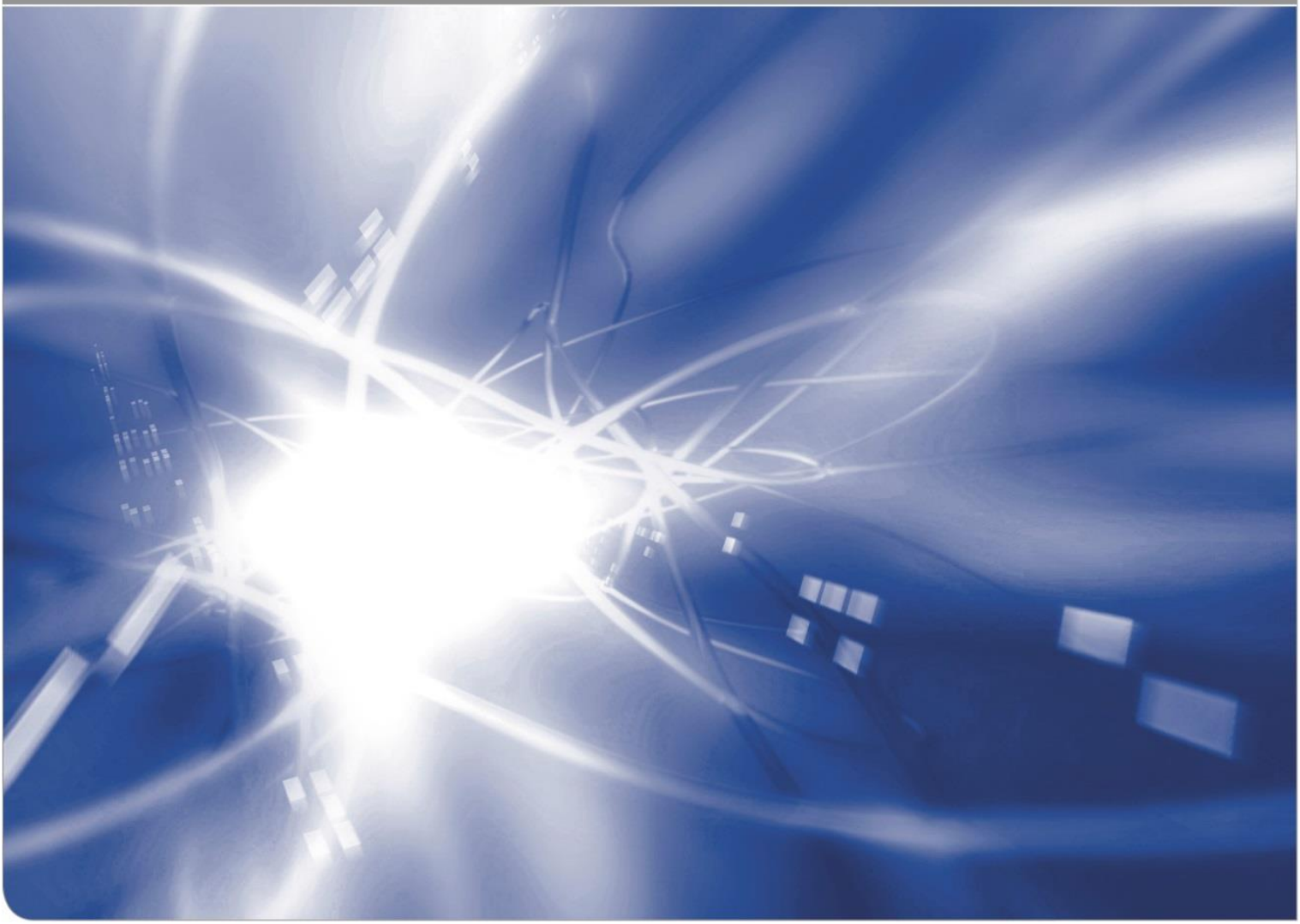

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Preface

This volume contains selected research papers and extended abstracts from the Workshop on "Designing User Assistance in Interactive Intelligent Systems" of the 26th European Conference on Information Systems – held from June 23 to June 28 in Portsmouth, UK.

This workshop is the successor of two other workshops on "Designing User Assistance" held at ECIS 2017 in Guimarães, Portugal, and at the WI (Wirtschaftsinformatik) conference 2017 in St. Gallen, Switzerland. The workshop has a focus on the design of systems providing user assistance. We define user assistance as a specific capability of interactive intelligent systems that help users to perform their tasks better. Thereby, user assistance is a human-, task-, and context-dependent augmentation of task performance bridging the gap between the system's functionalities and the human's individual capabilities with the goal of positively influencing task outcomes. User assistance can be classified along two dimensions: (1) the degree of interaction enabled by user assistance, and (2) the degree of intelligence of user assistance. The degree of interaction characterizes the assistance systems capability to support humans in an ongoing reciprocal and activating dialog using, potentially, different channels. The degree of intelligence describes the capability to provide assistance based on the human, the context, and the current activity. User assistance can be instantiated in many different forms such as decision aids, recommendation agents, virtual assistants, guidance systems, task-support systems, conversational agents, chatbots, or robo-advisors.

We received eight submissions for the workshop out of which we were able to accept six submissions as either full papers or extended abstracts. Each of the submissions was reviewed in a double-blinded process by two reviewers of the program committee and the workshop organizers. In total, this volume now contains three full papers and three extended abstracts.

We would like to thank all authors who submitted their papers to our ECIS 2018 Workshop on "Designing User Assistance in Interactive Intelligent Systems". We trust that the readers will find them as interesting and informative as we do. We would like to thank all members of the program committee as well as the additional reviewers who took their time to provide detailed and constructive critiques for the authors. Furthermore, we would like to thank the Karlsruhe Institute of Technology (KIT), which made the publication of this volume possible. We believe the papers in these proceedings provide many interesting and valuable insights into the research on user assistance systems. They open up new and exciting possibilities for future research in the discipline.

June 2018
Stefan Morana
Jella Pfeiffer

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A STUDY TO ASSESS USERS' PREFERENCES FOR INTELLIGENT PERSONAL ASSISTANCE AND IMPROVE THEIR MASS ADOPTION

Research in Progress

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Despite the dissemination and wide availability of Intelligent Personal Assistants (IPA), such systems have not reached the popularity expected. One reason for this is the users' lack of trust in IPA and their providers. Another reason is the IPA's limited performance and skill set, which in turn is due to the intentional segregation of IPAs in proprietary ecosystems. Enabling IPAs to communicate and exchange data with each other could help IPAs improve performance and thus their acceptance among users. Further, certifications and suitable marketing strategies can also contribute towards their mass adoption, by fostering user's trust in IPA and their providers. To better understand the incentives necessary to instigate mass adoption of interoperable IPAs, this paper presents a survey which captures the potential users' attitude towards interoperable IPAs and their attitude towards different marketing strategies which could increase users' trust in IPAs. The ultimate purpose of this ongoing research is to develop design recommendations and an efficient incentive system that can foster the mass adoption of IPAs.

Keywords: Adoption of Intelligent Personal Assistants, User Preferences for Interoperable Assistance Systems; Incentive Systems for Adoption.

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1 Introduction

Advancements in technology and artificial intelligence abet the development of a plethora of sophisticated, intelligent personal assistants (IPA) aimed at supporting their user in everyday life. Apple's Siri, Samsung's Bixby, Google's OK Google, Microsoft's Cortana and Amazon's Alexa are the most popular IPA's. These IPAs are mobile in use, voice-controlled and their capabilities include searches for things on the web, reading the weather forecast, setting alarms, calling people or creating reminders and calendar entries. Besides some exceptions (e.g. Amazon's Alexa), most IPA's come for free on smartphone devices but are also increasingly available in smart homes and cars (Cowan et al. 2017). However, despite being available to anyone owning a smartphone with an Internet connection, people do not use IPAs on a regular basis (Cowan et al. 2017). As research on user interaction and experience with IPAs shows, only 30% of iPhone owners use Siri, and 38% of Android owners use OK Google regularly (Milanesi, 2016). The rest of smartphone users either have not used Siri or OK Google at all (i.e. 2% and 4% respectively), or use it only too rarely (i.e. 70% and 62% respectively) (Milanesi, 2016).

Recent studies exploring the users' experience with IPAs (e.g. Cowan et al. 2017) reveal that IPA users often undergo suboptimal performance and support quality of IPAs, as well as a lack of trust in such systems (i.e. concerns about the data privacy, monetization, data permanency, and transparency). Indeed, though the IPAs' current capabilities are continuously extended, IPAs remain far from being proactive, omniscient and context-sensitive companions. Research studies testing the knowledgeability of IPAs, show the limitations of such systems. Siri, for instance, answers on average only 21.7%, and Alexa only 20.7% out of 5000 general knowledge questions they might get asked, whereby the number of correct answers given is even lower (Enge, 2017). Google and Cortana, on the other hand, can answer up to 68.1% and 56.5% of the questions asked. This difference illustrates how IPA performance depends on the amount of data and the quality of available data sources. The more and better data sources IPAs have at their disposal, the more versatile and qualitative their support.

To date, existing IPAs are limited to a large extent to the proprietary platforms of their vendors or operators. This segregation hinders the IPAs' ability to combine data and services across vendors and data sources, and thus the achievement of the IPAs full potential. To solve this problem enabling IPA's to talk to each other enables the provision of ubiquitous assistance, which can again foster the mass adoption of IPAs. On the other hand, enabling IPAs to communicate with each other might give rise to data privacy, data security and data ownership issues, which in turn represent another impediment to the IPAs market success. As users are increasingly data security and privacy aware (Statista 2015a; Statista 2015b), trust in IPAs systems is decisive for their mass adoption (PWC, 2017).

In general, IPAs have enjoyed extensive interest from both business and academia. Thus it is surprising that studies exploring possibilities and incentive systems to promote their mass adoption are scarce. This research in progress addresses this void in research and seeks to formulate and test a suitable incentive system for mass adoption of intelligent assistant systems. The basis for the development of a suitable incentive system for mass adoption builds on empirically backed insights about the users' general attitude towards enabling IPAs to communicate with each other, as well as users' attitude towards different strategies that could increase users' trust in IPAs (e.g. certification, selected business models, various marketing strategies).

Formally, this paper is structured as follows: after presenting related studies and theories, the paper presents the survey used for the data collection. Subsequently, after presenting the results of the survey, this paper discusses the main findings and concludes by presenting the next steps planned, to advance this research in progress.

2 Related Work

2.1 Intelligent Personal Assistants

The idea of intelligent agents has been around for decades (Foner 1993), but only recent advancements in technology facilitated a boom in intelligent assistance. Per se, IPAs are computer systems featuring anthropomorphic interfaces (i.e. they are personified and can, for instance, interact with the user in natural language) and artificial intelligence, which allows them to be aware of the user's location, and gather and evaluate contextual information (Jennings, 2000; Hauswald et al. 2015) with the purpose of making suitable recommendations or performing actions on their user's behalf.

Prevailing business and academic interest in the area of IPA motivated various research efforts on this topic so that the existent body of literature presents a plethora of studies on technical topics (e.g. advanced toolsets and methodologies (e.g. Brézillion 2014; Kim et al. 2014) new use cases and even new types of IPAs (e.g. Hauswald et al.2016; Büyüközkan and Ergün2011), and research efforts on trust, acceptance and user experience when using existing IPAs. Moorthy and Vu (2014) for instance test the individuals' attitude to use IPAs in public; Strayer and colleagues (2017) explore the users' experience and cognitive workload while using IPAs in cars; Kiseleva and colleagues (2016) evaluate Cortana's effectiveness in supporting their user; while Cowan et al. (2017) assess infrequent users' experience with Siri and identify six key issues disturbing users' experience when using Siri. They argue that the main cause of user frustration is the limited integration of IPA with other platforms, services or other apps. Further, they also find that other factors that cause inconvenience when dealing with IPAs are data privacy, confidentiality, and monetization issues. Combined, these insights suggest that enabling IPAs to interact with other IPAs, platforms or services while gaining the users' trust concerning data security and privacy can foster the mass adoption of IPAs significantly.

2.2 Trust and Diffusion of Innovative Technology Products

As in the case of any new technology product, its adoption and thus market success depends on a variety of factors influencing peoples' decision to adopt or reject the new technology. So, the reasons for adopting new information systems was studied in several contexts and great depth. Accordingly, there exist several studies assessing the key elements driving the adoption of new technology products. Agarwal and colleagues work (1998), for instance, draws on Rogers' theory of diffusion of innovations (1995) to explain the adoption of new technology products. According to Rogers' theory, users' decision to adopt a new technology product is the outcome of a process which starts with the users' search for product and product vendor related information. Once users know about the product in question, its features, as well as the consequences using that product, they form beliefs that will help them decide when to adopt a product. According to this theory, based on the timing of the decision to adopt, users can be classified into five groups of adopters. One of the critical groups promoting mass adoption is the group of "early adopters" – i.e. opinion leaders who can persuade others to adopt by providing evaluative information. Also noteworthy is that in a previous academic effort, Agarwal and colleagues (1997) show evidence from a field study that innovation characteristics explain acceptance behavior so that innovative products should enjoy a broader acceptance and adoption than less innovative products.

In addition, the existent literature suggests that trust is another decisive factor for the market success of IS related artifacts and services (e.g. Bélanger and Carter 2008; Chen and Barnes, S. 2007; Benbasat and Wang 2005; Featherman and Pavlou 2003; Pavlou 2003).

In fact, trust is, in particular, relevant for the adoption of new technology products where uncertainty and risk concerns related to using the new product make users hesitant towards trying such products (McKnight et al. 2002a; McKnight et al. 2002b). Accordingly, several scholars worked on identifying the key drivers of building trust. For instance, McKnight and colleagues (2002b) developed and tested a model for building trust in the context of e-commerce. In their contribution, these scholars propose three factors for building trust in e-commerce vendors: structural assurance (that is, consumer perceptions of the safety of the web environment), perceived web vendor reputation, and perceived web site

quality. In another contribution, McKnight and colleagues (2002a), also show that the disposition to trust is positively related to the potential users' innovativeness. Also, more recent studies on trust in the context of e-commerce provide empirical evidence that third-party certification, reputation, and the vendors' return policy are significant trust building mechanisms (e.g. Chang et al. 2013; Kim and Peterson 2017). Kim and Peterson (2017) for example, performed a meta-analysis of online trust relationships in e-commerce. Based on the existent literature, they selected and studied several mechanisms for trust building. Their results confirm that factors such as perceived privacy, perceived reputation, perceived usefulness, attitude, and purchase intention indeed impact the trust-building process in online commerce in a statistically significant manner. Nevertheless, these findings stem from the realm of e-commerce and do not necessarily apply to the context of IPAs. On the one hand, in order to provide their user with holistic and useful support, IPAs gather and combine a variety of personal and context relevant information. Because the collection, processing and storage of such data by a central entity such as the IPA raises several data privacy and security related concerns, users might display higher mistrust levels towards IPAs than towards any other e-commerce applications. On the other hand, if taking into consideration that the IPAs main goal is to support the user in their everyday life, they might view IPAs (especially such with anthropomorphic traits) as human interlocutors, or teammates (Nass et al. 1996), and thus display a higher willingness to trust such IPAs. In the case of e-commerce however, where users know that recommender systems' primary goal is linked to a companies' increases in sales, users might be inclined to trust recommender systems less than IPAs. Based on this ambivalence, we highlight the necessity to validate the insights presented by the e-commerce literature within the special context of IPAs. Accordingly, the survey in this paper explores the transferability of the previously stated constructs and trust building mechanisms to the research context of interoperable IPAs.

3 User Study

As mentioned previously, this study explores the potential users' general attitude towards enabling IPAs to communicate with each other, and their view on the issues arising from this endeavor. In addition, it also studies the users' attitude towards strategies and mechanisms which could increase users' trust in IPAs via a computer-administered survey. For this purpose, a market research institute was hired to provide a suitable sample for our survey. From the originally 450 participants who took the survey, a total of 229 individuals completed the questionnaire by providing us with all the information needed for this analysis. The final sample features an almost equal gender split, with 53% of the participants being male and 47% female. All participants in the survey were between 18 and 69 years old, whereby the majority of participants were between 40 and 59 years old (52%). 18% of participants were between 18 and 29 years old, and 12% were between 30-39 years old. The remainder (18%) of participants were over 60. 51% of the participants are married, and 56% have one or more kids. Regarding education, only two participants were still attending school, one had no school degree, but most of the participants (51%) hold either a high school degree or a university diploma.

3.1 Survey Design

This survey is based on an exemplary case study which visualizes the amenities of interconnecting several IPAs with each other. At the beginning of the survey, users were shown a use case in which a connected car IPA can exchange information with a smart home and a public transportation IPA in order to assist their users in tackling multiple challenges. In the use case presented, the user is on his way home, where he expects a few hours of guests to a private event. Due to an accident, the user's plans and preparations for the event must be changed or rescheduled. However, the IPAs help him to come home in time and to prepare his smart home for the private event without stress.

Based on the use case shown, participants were asked to rate several statements on Likert scales. The statements prompted in the survey originate from the existent body of literature and capture the participants' attitude towards connecting IPAs, elicits their preferences for trust building mechanisms. Below, an overview of the constructs addressed in the survey.

Construct	Reference
Perceived usefulness	Vijayasarathy (2004); Pavlou (2003); Davis (1989)
Attitude towards the product (i.e. interoperable IPAs)	Cowan et al. (2017); Vijayasarathy (2004); Davis (1989)
Intention to use	Davis (1989)
Purchase intention	Kim et al. (2009)
Interoperability of IPAs with other IPAs, apps, and services	Cowan et al. (2017); Vijayasarathy (2004)
Innovativeness (product and participant)	Agarwal and Prasad (1997);
Trust and trust building mechanisms: e.g. third-party certification, reputation, return policy	Chang et al. (2013); Komiak and Benbasat (2006); Benbasat and Wang (2005); McKnight et al. (2002a); McKnight et al. (2002b)
Trust and risk perception of monetary loss	Pavlou (2003)
Trust and risk perception of loss of privacy	Pavlou (2003); Vijayasarathy (2004)
Trust and country of origin	Jiménez and Martín (2010)
Trust and business models (i.e. data monetization, advertisement based revenue)	Cowan et al. (2017)
Information sources and marketing channels (e.g. WOM)	Parry et al. (2012); Molitor et al. (2011); Agarwal et al. (1998); Mahajan et al (1990); Rogers (1995)

Table 1. Overview of the constructs address in the survey.

3.2 Results

3.2.1 Participants' attitude towards interconnected IPAs and related services

The usage pattern of IPAs discovered by previous literature is also visible in our sample. Accordingly, the majority of participants (59%) do not use the smartphone installed IPAs ever, 2% (i.e. 5 participants) did not know what IPAs are at all, 31% use it only sometimes, and only 7% use the IPAs on their phone more often (see Table A1 in Appendix). Regardless the participants' current usage of IPAs, the majority of participants (i.e. 58%) display a positive attitude towards the assistance scenario presented in the survey. Only 10% have a negative attitude towards enabling IPAs to communicate with each other, and the remaining 30% are still undecided regarding their attitude towards such IPAs. The vast majority of participants, however (71%) rate the idea of interconnecting IPAs as innovative, meanwhile only 7% disagree. Even so, 71% of the participants think that it is desirable to connect more than one area of assistance and perceive this undertaking as useful (70%). In contrast, only 27% do not think that such an endeavor is desirable, as they do not regard it as useful at all (18%). Meanwhile, the remainder of the participants is unsure if interconnecting IPAs to provide more ubiquitous assistance is useful (10%) or desirable for them (27%) (see Table A1 in Appendix). Related to the participants' needs for assistance, it is noteworthy that public transportation, smart city, connected car, e-government and smart home are the areas where the majority of participants would like to use IPAs. In contrast, health, job, and education related assistance are not among the participants' top priorities (see Table A2 in Appendix).

Regarding the IPA and related services, it is noteworthy that the majority of participants consider data security and privacy compliance (74%); an intuitive and user friendly control logic (74); the support services offered by IPAs providers (71%); a low system error rate (70%); and certifications according to German standards, as essential factors influencing the decision to use or not to use IPAs In contrast, characteristics such as image and reputation of the IPA provider, as well as the number of ancillary products are important but only to half of the participants (see Table A3 in Appendix). Surprisingly, despite the participants' awareness related to data security and privacy, the origin of the IPA provider or the origin where the data of the IPA is hosted (i.e. EU hosted, USA designed) does not matter in this

context (see Table A4 in Appendix). As the survey data shows, the participants in this study value the feature set and price-performance ratio of technological products more than their origin.

Finally, it is surprising that despite the broad positive perception of the usefulness brought by interconnected IPAs, only 28% can seriously imagine using interoperable IPAs, about half (51%) of the participants are still unsure if they would use the interconnected IPAs indeed more IPAs. One potential reason, therefore, is the participants' lack of trust in IPAs and their service providers, as well as the participants' concerns for data security, privacy, and transparency.

3.2.2 Participants Trust in IPAs and attitude towards certifications

With regard to the participants' fears about IPAs, it is surprising that 43% (i.e. 99) participants fear that IPAs will limit their freedom of choice and freedom of action, while 14% (i.e. 31) participants are still uncertain regarding this topic, and 43% of them do not share this fear at all (see Table A4 in Appendix). To provide personalized support, IPAs need to know and store the preferences of their user. However, 63% of the participants feel uncomfortable if the IPAs know their personal preferences. In contrast, only 23% of the participants have no problem with the IPAs holding vast personal information about them. In addition, 79% are afraid that their personal information could be misused. Moreover, 42% of participants are actually fearful that IPAs can bring them into uncontrollable and dangerous situations (see Table A5 in Appendix). These findings show that many participants mistrust IPAs and their providers, and corroborate the insights provided by the insights provided by the e-commerce literature. Another example of the participants' lack of trust in IPAs is the fact that 55% of participants would let the IPA perform transactions on their behalf only if they can keep control over each transaction. On the contrary, 12% would not approve for IPAs to perform any transactions on their behalf, even if they had suitable control mechanisms available. In case of automatic transactions without previous control by the IPA's user, most participants' (37%) limit is 10€. In other words, 37% of the participants would allow their IPAs to perform only transactions automatically, only if these do not exceed €10 (see Table A6 in Appendix).

A conventional mechanism for building trust in products and providers, in general, are certifications. Related to certifications, the evaluation of the survey data reveals that at large, participants tend to trust well-established certifications, even though they do not know exactly and in detail what these certifications entail and confirm. Amongst the prompted certification seals, the majority of participants know the established third party seals issued by the TUEV and ISO organizations. In addition, the majority of participants also recognize the BSI data security certification seal issued by a German governmental agency but are less familiar with the ePrivacy seal or the GDD seal, which are both certifications issued by other third-party companies.

Given the increasing number of certifications available on the market, participants and users, in general, are facing high uncertainty about the real meaning and importance of such certifications. Subsequently, 30% of the participants trust unknown certifications only if federal organizations award them. Meanwhile, the majority of participants (i.e. 41%) are unsure if they should or should not trust new certification seals at all (see Table A7 in Appendix). Regarding the IPAs attributes for which participants expect or wish a particular certification (see Table A8 in Appendix), it is not surprising that the majority of participants expect their IPAs to hold certifications for data security and privacy compliance and user-friendliness. In addition, participants would like to have a certification attesting the vendor independence of the IPA and support service quality offered by the IPA provider. In fact, it is noteworthy that participants display a strong wish for support service and would like to receive any kind of support, be it in the form of an online forum or chat (67%), a knowledge database for self-fixes (73%), or via a hotline (79%) (see Table A9 in Appendix).

3.2.3 Preferred marketing and information channels

Given the high number of participants who have not yet made up their mind regarding the trustworthiness and usefulness of IPAs, suitable marketing strategies might be helpful tools to tilt their beliefs in a positive direction.

Concerning the testing habits of our participants (see Table B1 in Appendix), it is worth mentioning that a high expectation of usefulness of a product motivates 70% of the participants to test a product. Further, participants like to test new products which are on everyone's lips (61%). However, 53% of the participants wish to inform themselves about the characteristics of a product before testing it. As the results of the survey suggest (see Table B2 in Appendix), in the context of new technology products WOM is the most effective channel for information and marketing, as 69% of the participants report that when deciding to purchase new technological products, they orientate themselves on the recommendations made by friends and family. In addition to WOM, participants consider recommendations in articles in technology-related media (37%), recommendations issued by influencer on social media (38%) and recommendations made by established technology testing or certification agencies (43%).

Regarding promotion channels (see Table B3 in Appendix),, again WOM is the most effective, followed by TV, Internet advertising, advertising in technology magazines. Accordingly, 67% learn about new technology products when talking to their friends and family; 51% and 48% notice such products via TV or Internet ads; 34% learn about new technology products from technology magazines. In contrast, only 30% of the participants learn about new technological products from social media sites like Youtube, and only 24% through mobile advertising. Surprisingly, 26% of the participants learned about new technology because they were preinstalled on their device.

3.2.4 Participants' willingness to purchase interoperable IPAs

From the 183 participants who did not exclude the use of interoperable IPAs, 36% (66 participants) would be willing to pay for interoperable IPAs, 27% (i.e. 49 participants) would not be willing to pay for such assistance, while 37% (i.e. 68 participants) have not yet made up their mind on this topic . However, when asked if participants would use interoperable IPAs if they were for free, 63% (115 participants) answered in the affirmative. 86 participants (47%) are even willing to accept advertising and product placement measures in their assistance, just to be able to use interoperable IPAs free of charge. Interestingly, what the majority of participants (62%) are not willing to accept is the monetization of their personal data in exchange for free assistance. Also noteworthy is that amongst participants willing to purchase IPA assistance, the majority (55%) would prefer a pay per use business model over other business models.

4 Discussion and further research steps

At large, the findings of this survey indicate that the participants have a positive predisposition regarding interoperable IPAs. In particular, enabling IPAs from the areas of public transportation, smart city, connected car, e-government and smart home to talk to each other could increase usage of IPAs if IPA providers simultaneously can raise the potential users' trust in them. Lack of trust in the IPAs actions, their data privacy, and security compliance, as well as lack of trust in IPAs providers, are also visible in this study's sample. Accordingly, although many of the participants in this study acknowledge the amenities, usefulness, and innovativeness of interoperable IPAs, they still hold important reservations holding them back from wanting to use such IPAs on a regular basis. The participants' reservations can potentially be alleviated by employing the right marketing strategies, business models or certifications. As the results of the survey indicate, participants trust certifications issued by well-established governmental and non-governmental institutions. Especially certifications concerning the IPAs' data security and privacy, user-friendliness and vendor independence could improve potential users' trust in such systems. Also, the provision of user support services could also be advantageous, as participants display a strong wish for support service.

Furthermore, the adoption of IPAs could be promoted by employing the right marketing strategies. Based on the results of the survey, WOM is the most effective channel for promoting interoperable IPAs. Other effective channels for marketing are TV ads, Internet advertising, advertising in technology magazines, or in some cases also influencer marketing on social media. Finally, IPA providers could insti-

gate IPAs adoption by keeping the IPAs assistance services free of charge, while simultaneously considering advertising-based revenue models over monetization strategies. Along these lines, increasing the transparency about data processing and data ownership will also benefit IPAs mass adoption.

I seek the discourse of this workshop to jointly discuss not only the results presented in in this paper, but also any ideas and suggestions for designing and performing a suitable experiment, which (1) can help us better understand trust building mechanisms in the context of IPA, and (2) captures the impact and effectiveness of several trust building mechanisms. The ultimate goal of this research in progress is to develop an effective incentive system to foster IPAs mass adoption.

5 Appendix: Constructs to be rated in the survey (detailed view)

5.1 Constructs assessed in this study- detailed view.

1. General attitude towards IPA interoperability: Participants' attitude towards enabling IPA's to exchange information with each other.
2. Interoperability domains: Which of the following areas do people value intelligent personal assistance the most? Areas of support include:
    - health assistance: e.g. IPA supports a healthier lifestyle
    - public transport: e.g. IPA helps its user to use the public transport in a more efficient way
    - connected car: e.g. IPA supports a more comfortable and entertaining driver experience
    - smart city: e.g. IPA supports their user in finding parking, paying for parking automatically
    - e-government: e.g. IPA helps you to fulfill administrative duties, such as in tax redemption, social benefits claims
    - smart home: e.g. IPA allows high living comfort and reduced costs by regulating the heating and the energy consumption of the household
    - education: e.g. IPA allows for more efficient and entertaining education by providing support which adapts to their users' learning habits
    - job-related assistance: e.g. IPA supports their user to perform their jobs in a less stressful manner by reminding their user about appointments, or automatically prioritizing tasks
3. Perceived usefulness: do participants consider interoperable IPAs as useful?
4. Perceived innovativeness: do participants consider enabling IPAs to communicate with each other as innovative?
5. Intention to use: can participants imagine to use IPAs if they were interoperable, as in the use case presented at the beginning of the survey?
6. Trust: do participants feel vulnerable if IPAs know and interconnect their data? Are participants concerned that their data will be misused? Are participants afraid that IPAs will bring them into a dangerous situation and they cannot do anything about it?
7. Preference for product origin: do participants have any preferences about the origin of IPAs? Would they prefer IPAs hosted in Europe over those hosted in other parts of the world?
8. Willingness to test new technologies and products: When do participants usually test new products? Regularly or always; only if there is a hype around the product; only if participants did prior research on the product and expect high utility from that product; only if well-known companies develop those products; never before purchasing
9. Preferences for support services: potential support services include: online support via chat or forum; online FAQ and fixes database; call center; no support
10. Preferred marketing channels: TV; Radio; Print; Online; Mobile advertising; Influencer marketing; Word-of-mouth (WOM)
11. Information search: Print, WOM; Social Media (e.g. Youtube); online communities experts;
12. Certifications and trust: participants indicate which European and German certification seals they are familiar with. The selection of seals include the most common certification seals in Germany: BSI; TUEV; ISO; Software made in Germany; Software hosted in Germany; EU Privacy Seal
    - Do participants tend to trust in general?
    - Do participants trust seals even if they do not know the details and goal of the certification process?
    - Do participants trust seals only if governmental entities issued them?
    - Do participants trust seals from third-party organizations?
13. IPA attributes certification: which attributes and related IPA services must or should be certified? The promoted attributes were: data security and privacy; data transparency; interoperability with other products, platforms, and apps; user-friendly operation; support services

In addition to these constructs that have been shown to all users, there are three more that are directed only to those who did not exclude the use of interoperable IPAs. The choice for this approach is based on the logic that participants who cannot imagine using interoperable IPAs should not rate statements about constructs such as purchase intent. These constructs are:

14. Purchase intention: would participants want to purchase interoperable IPAs?
15. Importance of IPA attributes and related services and potential business models: participants rate the importance of several IPA attributes for themselves. The attributes addressed were: IPA support features; complementary services; seamless interoperability with other third-party artifacts; user-friendly and intuitive control logic of IPAs (ease of use); support services offered by the IPAs providers; IPA provider reputation; certifications of the IPAs; data security certification
16. IPAs and money transactions: would participants allow IPAs to perform payments and purchases on behalf of their user?

5.2 Table A1: Users' attitude towards IPA in general

Are you currently using Siri, Google Now, Cortana, Alexa Samsung or another intelligent personal assistant?	Scale Items / Chosen by % of participants (n=229)						
	Yes, often (1)	*Yes, seldom (2)*	*No, never (3)*	*I am not familiar with these (4)*			
	7%	31%	59%	2%			
Do you think it is desirable that different IPAs can communicate with each other?	*Yes, surely (1)*	*Rather Yes (2)*	*Unsure (3)*	*Rather No (4)*	*No (5)*		
	21%	36%	21%	13%	8%		
How innovative is the IPA presented?	*Not innovative at all (1)*	*Only slightly (2)*	*Little innovative (3)*	*Unsure (4)*	*Rather innovative (5)*	*Innovative (6)*	*Very innovative (new product) (7)*
	0%	2%	4%	20%	24%	36%	14%
I think the IPA is…	*Not useful at all (1)*	*Not useful (2)*	*Rather not useful (3)*	*Unsure (4)*	*Rather useful (5)*	*Useful (6)*	*Very useful (7)*
	0%	3%	7%	18%	37%	23%	11%

5.3 Table A1: User preferences for support - most important areas of support

Areas of Support	Scale Items							*MEAN*	*SD*
	1	2	3	4	5	6	7		
	Not helpful at all	Not helpful	Rather not	Unsure	Rather helpful	Helpful	Very helpful		
Health	4%	7%	10%	17%	36%	14%	12%	*4.646*	*1.531*
Public Transport	2%	3%	3%	10%	29%	26%	28%	*5.504*	*1.359*
Conncected Car	4%	3%	7%	17%	28%	21%	20%	*5.039*	*1.563*
Smart City	3%	2%	5%	13%	25%	28%	24%	*5.367*	*1.444*
E-Government	3%	4%	5%	20%	27%	23%	18%	*5.048*	*1.490*
Smart Home	3%	3%	7%	20%	22%	28%	17%	*5.026*	*1.516*
Education	5%	7%	9%	27%	25%	18%	9%	*4.489*	*1.538*
Job related	7%	9%	7%	24%	21%	19%	14%	*4.568*	*1.709*

5.4 Table A3: User preferences for IPA attributes and related services

IPA Attributes and related services	Scale Items							MEAN	SD
	1	2	3	4	5	6	7		
	Not important at all	Not important	Rather not important	Unsure	Rather important	Important	Very important		
Functionality and support features	1%	2%	3%	23%	36%	23%	12%	*5.109*	*1.143*
Number of add-on products and services	1%	1%	11%	28%	32%	20%	7%	*4.765*	*1.160*
Interoperability with products from other manufacturers	1%	2%	6%	31%	18%	30%	12%	*5.005*	*1.307*
Low error rate	0%	0%	2%	11%	18%	30%	39%	*5.934*	*1.087*
Intuitiveness and ease of use	0%	0%	0%	8%	16%	34%	42%	*6.098*	*0.938*
Comprehensive documentation of features	1%	1%	5%	20%	26%	26%	21%	*5.328*	*1.263*
User-friendly support service	1%	0%	1%	9%	26%	35%	28%	*5.770*	*1.049*
Image and reputation of the service provider	2%	2%	8%	27%	22%	27%	11%	*4.923*	*1.332*
Certification of the IPA	1%	1%	3%	18%	27%	31%	21%	*5.448*	*1.170*
Data privacy certification in line with German standards	1%	1%	2%	10%	11%	24%	52%	*6.120*	*1.180*
High data security standards	0%	0%	1%	7%	7%	17%	68%	*6.454*	*0.942*

5.5 Table A4: User preferences for product origin and users' trust in IPA

Product Origin	Scale Items								*MEAN*	*SD*
	1	2	3	4	5	6	7			
	Not true at all	Not true	Rather not true	Unsure	Rather true	True	Very true			
I prefer high-tech products and services of German companies.	5.24%	6.99%	12.66%	32.31%	22.71%	11.35%	8.73%		*4.293*	*1.506*
I prefer high-tech products and services of European companies.	4.80%	6.11%	13.97%	44.10%	18.34%	12.23%	0.44%		*4.035*	*1.238*
I prefer high-tech products and services of US companies.	10.48%	10.48%	21.83%	41.92%	8.30%	5.24%	1.75%		*3.498*	*1.336*
The origin of the product is not important to me because the functionality is the most important to me.	1.31%	4.37%	8.30%	19.21%	27.51%	24.02%	15.28%		*5.004*	*1.410*
The origin of the product is not important to me because the price / performance ratio is most important to me.	0.87%	3.93%	4.37%	17.03%	33.19%	23.14%	17.47%		*5.170*	*1.322*

5.6 Table A5: User preferences for product origin and users' trust in IPA

Trust in IPA										
I am afraid that the intelligent assistant will restrict my freedom of decision and action.	11%	10%	21%	14%	21%	21%	10%		*3.991*	*1.809*
In general I do not feel comfortable if the assistant knows my preferences.	5%	8%	10%	14%	16%	23%	24%		*4.930*	*1.790*
I am afraid that my data will be abused and that I cannot do anything about it.	1%	4%	6%	10%	19%	22%	38%		*5.576*	*1.790*
I am afraid that the assistant puts me in a dangerous situation and I can do nothing about it.	8%	10%	19%	21%	19%	14%	10%		*4.135*	*1.710*

5.7 Table A6: User preferences for money transactions made by IPAs

In case that the IPA must perform and manage money transactions (e.g. book train tickets, parking lots, etc.), would you allow it?	Scale Items								*MEAN*	*SD*
	1	2	3	4	5	6	7			
	Not true at all	Not true	Rather not true	Unsure	Rather true	True	Very true			
No, I would never allow it.	10%	7%	11%	35%	10%	14%	13%		*4.213*	*1.755*
I am not sure yet.	11%	7%	11%	32%	17%	11%	10%		*4.120*	*1.712*
Yes, I would allow it, but only if I can review and approve all transactions individually before execution.	10%	3%	2%	16%	26%	25%	18%		*4.934*	*1.747*
Yes, I would allow it, but only for small purchases worth less than 10 euros. All other transactions should be explicitly confirmed by me.	16%	7%	6%	26%	14%	21%	11%		*4.224*	*1.921*
Yes, I would allow it, but only for small purchases worth less than 25 euros. All other transactions should be explicitly confirmed by me.	18%	9%	13%	28%	13%	11%	8%		*3.749*	*1.825*
Yes, I would allow it, but only for small purchases worth less than 50 euros. All other transactions should be explicitly confirmed by me.	23%	11%	10%	30%	11%	8%	6%		*3.443*	*1.820*

5.8 Table A7: Users' trust in certifications

Trust in certifications	Scale Items								MEAN	SD
	1	2	3	4	5	6	7			
	Not true at all	Not true	Rather not true	Un-sure	Rather true	True	Very true			
Because I know exactly what the displayed certification seals mean, I trust them.	6%	10%	18%	31%	25%	8%	2%		*3.943*	*1.364*
Although I know exactly what the displayed certification seals mean, I still do not trust them.	8%	16%	24%	33%	12%	6%	1%		*3.476*	*1.326*
Although I do not know exactly what the displayed certification seals mean I would tend to trust them.	3%	7%	17%	28%	35%	9%	2%		*4.201*	*1.244*
Because I do not know exactly what the displayed certification seals mean I cannot trust them.	8%	12%	25%	31%	14%	7%	3%		*3.651*	*1.411*
If I do not know exactly what a certification seal means, I trust it only if it comes from a federal association or from a federal organization.	4%	9%	16%	41%	22%	7%	1%		*3.939*	*1.223*
I generally do not care which certification a product carries, as long as data security and privacy compliance has been confirmed by a state organization or a federal association.	6%	7%	16%	39%	22%	8%	2%		*3.948*	*1.290*
I generally do not care which certification a product carries, as long as data security and privacy compliance has been confirmed by a third neutral organization.	10%	8%	21%	39%	14%	7%	2%		*3.664*	*1.362*

5.9 Table A8: User preference for certification

In which areas would you wish or expect a certification?	Scale Items						MEAN	SD
	1	2	3	4	5			
	Not important	Rather not important	Unsure	Important	Expected			
Data security	0	4	8	40	177		*4.703*	*0.621*
Transparency about what happens with my data	1	2	12	45	169		*4.655*	*0.661*
Interoperability with products from other companies	0	14	26	118	71		*4.074*	*0.816*
User friendliness	0	8	9	80	132		*4.467*	*0.735*
Service and support quality	0	4	22	105	98		*4.297*	*0.713*

5.10 Table A9: User preference for support

User preferences for support	Scale Items								MEAN	SD
	1	2	3	4	5	6	7			
	Not true at all	Not true	Rather not true	Unsure	Rather true	True	Very true			
I would like to have an online support (for example in the form of a chat or forum).	2%	4%	7%	20%	34%	21%	13%		*4.926*	*1.373*
I would like to have an extensive Knowledge Database so I can solve my problems and mistakes myself.	2%	3%	6%	16%	31%	28%	14%		*5.131*	*1.325*
I would like to have a call center type of support.	2%	2%	3%	14%	24%	34%	20%		*5.397*	*1.342*
I do not necessarily wish for any support at all. I can handle everything alone, with the information available on the Internet.	24%	20%	19%	22%	10%	3%	2%		*2.904*	*1.542*

5.11 Table B1: User preferences – When do users like to test new technology products

	Scale Items								MEAN	SD
	1	2	3	4	5	6	7			
	Not true at all	Not true	Rather not true	Unsure	Rather true	True	Very true			
When new technology products come on the market, I am usually one of the first to test these products.	35%	22%	15%	11%	10%	3%	3%		*2.616*	*1.676*
Whenever the test of new technology products and services is free and does not entail further obligations, I do test such products.	7%	8%	10%	22%	30%	13%	10%		*4.371*	*1.627*
I get curious when the product / service is on everyone's lips.	3%	7%	11%	18%	38%	17%	6%		*4.576*	*1.373*
I only test if I really expect a great benefit. Otherwise it is lost time.	2%	5%	6%	17%	31%	24%	16%		*5.044*	*1.423*
I mostly only test the products and services of companies that I know.	7%	9%	21%	25%	28%	7%	3%		*3.939*	*1.419*
I only test when I have carefully researched the product and its functionality and have studied detailed product information and tests.	3%	5%	16%	24%	29%	16%	8%		*4.511*	*1.401*
Usually, I do not test products. I buy them directly.	19%	24%	20%	15%	14%	5%	3%		*3.070*	*1.634*

5.12 Table B2: User preferences for product recommendations

How do you inform yourself when buying high-tech products and Services?	Scale Items								*MEAN*	*SD*
	1	2	3	4	5	6	7			
	Not true at all	Not true	Rather not true	Unsure	Rather true	True	Very true			
I buy products that are recommended by magazines and other online media.	12%	12%	15%	24%	26%	10%	2%		*3.764*	*1.561*
I buy based on experiences / recommendations from friends or family members.	5%	3%	7%	16%	40%	22%	7%		*4.777*	*1.401*
I buy based on reviews and recommendations from the internet and social media (for example Youtube).	10%	9%	16%	27%	26%	9%	3%		*3.891*	*1.534*
I buy products based on reviews and recommendations issued by specialized communities.	13%	13%	24%	24%	22%	3%	2%		*3.467*	*1.470*
I am not guided by recommendations, but by the existence of various certifications and certificates (for example, TUeV certified, ISO certified, etc.).	7%	6%	18%	26%	30%	11%	3%		*4.083*	*1.423*
I am not looking into others' opinions. I make decisions based on my own experiences, research and tests.	2%	5%	15%	25%	31%	16%	5%		*4.489*	*1.310*
I am not looking into certifications. I make my decisions based on my own experiences, information and tests.	3%	10%	17%	27%	25%	12%	6%		*4.201*	*1.446*

5.13 Table B3: User preferences for marketing channels

Thinking about high-tech products that you already own: Which channels draw your attention towards them? Please rate following statements:	Scale Items								*MEAN*	*SD*
	1	2	3	4	5	6	7			
	Not true at all	Not true	Rather not true	Unsure	Rather true	True	Very true			
I learned about them mostly through Radio ads.	21%	20%	21%	15%	16%	5%	2%		*3.070*	*1.618*
I learned about them mostly through TV ads.	10%	11%	15%	13%	30%	14%	8%		*4.131*	*1.742*
I learned about them mostly through ads in tech journals.	18%	12%	18%	16%	23%	9%	4%		*3.594*	*1.761*
I learned about them when surfing in the Internet on my notebook.	7%	14%	14%	17%	30%	14%	5%		*4.092*	*1.632*
I learned about them through ads on my mobile phone.	22%	18%	22%	14%	14%	7%	3%		*3.140*	*1.709*
I learned about them through technology podcasts	24%	17%	19%	15%	16%	8%	1%		*3.105*	*1.683*
I learned about them through technology related radio shows	38%	23%	15%	13%	7%	2%	2%		*2.419*	*1.507*
I learned about them from Magazines.	22%	16%	14%	14%	21%	8%	6%		*3.424*	*1.866*
I learned about them when surfing in YouTube, Facebook or other social media sites.	21%	18%	13%	17%	18%	7%	5%		*3.345*	*1.801*
I learned about them through recommendations of family and friends.	8%	5%	7%	14%	38%	21%	9%		*4.642*	*1.601*
I became aware of them because they were preinstalled on my device.	18%	15%	17%	24%	17%	6%	3%		*3.362*	*1.634*

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AN INVESTIGATION OF THE EFFECTS OF ANTHROPOMORPHISM IN COLLECTIVE HUMAN-MACHINE DECISION-MAKING

Extended Abstract

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1 Introduction

Anthropomorphism describes the attribution of human-like physical or non-physical features, behavior, emotions, characteristics and attributes to a non-human (Epley et al. 2007). The human tendency to humanize (socio-)technical systems can be used in the development of anthropomorphic information systems (IS) to reduce emotional distance to the IS and to create a natural connection between human beings and (socio-)technical systems or its components (Epley et al. 2007; Pfeuffer et al. 2018). In particular, new technologies make it possible to implement increasingly human-like features that further increase familiarization with IS. Increasing cognitive and emotional intelligence, contemporary and avant-garde interface design contribute to perceived human-likeness and anthropomorphism.

By enhancing IS with such complex anthropomorphic cues, it is also possible to develop increasingly advanced user assistance systems that adapt to the current context and the needs of their users. Advanced User Assistance Systems (AUAS; the acronym is used for both the singular and plural) are IS that support users in fulfilling a task by not only offering advice on a topic, but also referring to the user's current activities and environmental conditions in order to provide context-related recommendations and advance interaction between users and with the IS (Mädche et al. 2016). Based on this technological progress, we increasingly see groups of both humans and AUAS interacting in a collectively intelligent way (Gimpel 2015). In such collectively intelligent group decision-making settings, information and communication technologies increasingly do not only take the role of merely providing tools for humans to communicate and collaborate more effectively.

However, negative emotional responses can also occur if the IS have characteristics that are very similar to those of humans (e.g., “uncanny valley”, Mori (1970)). To ensure the acceptance of AUAS and thereby create successful assistance relationships, it is necessary to better understand how humans react to anthropomorphic cues and how they affect the collaboration with AUAS (Pfeuffer et al. 2018). Earlier research in the field of IS focused on technical implementation of anthropomorphic cues, such as designing the appearance and movements of robots (Duffy 2003; Walters et al. 2008) and virtual avatars. Researchers investigated the interaction between AUAS and humans, but results are often lim-

ited to supporting functions. Research to date has hardly addressed the impact of anthropomorphic cues of AUAS on the interaction in which AUAS act as intelligent social actors collaborating with human beings. It is unclear whether the positive effects of the use of anthropomorphic cues also leads to an improvement of decision quality made in the collaboration process. In particular, there is no integrated theory that allows to understand and to explain the dependencies between the anthropomorphic cues of AUAS and the decision quality that apply during collaboration.

Based on this background, our overarching research question is: *In the context of group decision-making under risk by collectives of humans and advanced user assistance systems, what are the effects of anthropomorphism on the quality of the decision, the satisfaction with the decision, and the personal responsibility for the decision?*

2 Research model

The present research bases on prior work, especially from the IS, human-computer interaction, (small) group decision-making, and social psychology literature. It builds on knowledge from research areas such as artificial intelligence, knowledge representation, reasoning techniques and formal computational modeling. Additionally, findings from the field of human-computer interaction, such as information presentation, interaction design and affective computing, are also used. This knowledge is combined with findings from the field of group decision-making, which examines the different forms of collaboration in (human) groups with two or more. Figure 1 sketches the research model. Conceptualizations and reasoning behind the hypothesis are presented in the full paper that is available from the corresponding author upon request.

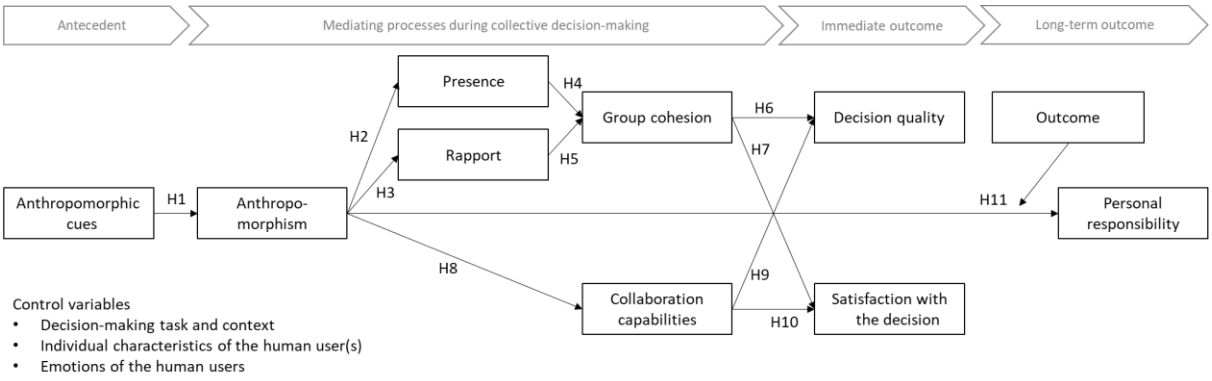

Figure 1: Research model.

3 Sketch of a potential experiment

For a first empirical test of our hypotheses, we aim to conduct a laboratory experiment in which we confront human participants with a complex decision-making problem under risk. We plan to first start with "very small group decision-making" involving groups of two participants: one human participant, one AUAS. This extreme case of group decision-making falls within the larger context of collective human-machine decision-making as described above. Having only dyadic interactions increases experimental control as compared to larger groups.

Three experimental treatments are planned in a between-participant design. In each of these treatments, an individual participant collaborates with an AUAS to solve a complex decision-making problem under risk. The intensity of anthropomorphic cues is the treatment variable. To compare the experimental groups in terms of decision quality, it is important that the advisors in different treatments each have identical cognitive abilities, as otherwise it is not possible to distinguish whether a potential effect can only be attributed to the degree of anthropomorphism or is caused by the improvement of cognitive abilities. Therefore, we will focus on the appearance and visual behavior of the advisor (facial expression, gestures) and relational cues like self-disclosure, empathy, humor and meta talk.

The results should help in refining the research model. Eventually, larger groups and other experimental tasks can be studied.

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ENHANCING USERS' TRUST IN SECOND-GENERATION ADVICE-GIVING SYSTEMS

Extended abstract

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Abstract

Advice-giving systems (AGSs), sometimes also called recommendation agents or recommender systems, are decision aids software that provide users personalized recommendations based on users' unique preferences or needs (Xiao and Benbasat, 2007; 2014). Due to their effectiveness in reducing users' information overload (Komiak and Benbasat, 2007) and facilitating users' decision-making process (Wang and Benbasat, 2008), AGSs have been considered as key influential factors of the success of online shopping websites in facilitating product customization and increasing revenue in e-commerce (Komiak and Benbasat 2006).

First-generation AGSs generate advice by asking users to explicitly indicate their product attribute preferences or needs. Such systems are usually labelled as content-filtering recommendation agents (Wang and Benbasat, 2005) and provide users with recommendations that best meet their preferences. Users who rely on such advice-giving systems to make decisions need to have a clear idea about their needs, to spend effort in identifying them, and then expressing or conveying them to the AGS. In recent years, another kind of AGSs, what we will label as second-generation AGSs, have become increasingly popular. Examples of second-generation AGSs include recommendations that appear in the homepages of websites such as Amazon, eBay, and Netflix, and content/ad push in websites like Facebook and Twitter. Unlike first-generation AGSs which directly ask users to provide their inputs of needs, second-generation AGSs implicitly collect and identify users' information, such as users' demographic information, past browsing behaviors, purchase behaviors, relationships with other users (Briggs and Smyth, 2006; Zhou et al., 2012), etc., and use these information as the input for their advice-generating process. In addition, compared to first-generation AGSs, second-generation AGSs employ more complex techniques to analyze data from a diverse set of input sources and generate advice for their users accordingly. Item-based collaborative filtering, an algorithm that generates advice similar to what users have adopted/bought before, and user-based collaborative filtering, an algorithm that offer users advice liked by other users who are similar to them, are basic techniques that support second-generation AGSs (Konstan and Riedl, 2012; Zhou et al., 2012). Based on these techniques, more advanced AGS models have already been suggested (Briggs and Smyth, 2006; O'Donovan and Smyth, 2005; Walter et al., 2008). For example, some researchers proposed a new kind of users-based collaborative filtering models that take into consideration the trust relationship among users (Zhou et al., 2012) to provide users with advice that are liked by other users whom they trust more.

Due to the effective decision aids AGSs bring to website users, it is important for website managers to know how to maximize user adoption of their AGSs in order to attract more users and increase website profits. Trust, as a crucial influential factor in IT adoption, has been shown to have an influence on users' adoption of AGSs (Al-Natour et al., 2008; Komiak and Benbasat, 2006; Wang and Benbasat, 2005; 2008) and product purchase intentions (McKnight et al., 2002; Wang and Benbasat, 2007). Us-

ers' trusts in AGSs can be influenced by a number of antecedents (for a summary, see Söllner, Benbasat, Gefen et al., 2016; Söllner and Leimeister, 2013). According to the framework developed by Wang and Benbasat (2008), we summarized the trust antecedents of AGSs, for both first- and second-generation ones that have already been studied in the existing literature, into six categories, namely dispositional reasons, institutional reasons, heuristic reasons, calculative reasons, interactive reasons, and knowledge-based reasons. Dispositional reasons include users' general predispositions to trust other parties. Institutional reasons include societal structures (e.g., legislation, rules, and third-party assurances) that people believe will make an environment trustworthy. Heuristic reasons include users' impressions of the website/e-vendor and users' past experiences with the system. Calculative reasons include users' perceived intelligence/efficiency/personalization of systems, users' privacy concerns, and users' perceived possibility/solutions of systems' mistakes/opportunistic behaviors. Interactive reasons include users' perceived control over systems, users' social presence, users' perceived ease of use, users' perceived similarity with systems, users' perceived adaptiveness of systems, users' decision confidence, etc. Knowledge-based reasons include explanations of how advice is generated/why AGSs ask certain questions.

Over the past decade, users' trusts in first-generation AGSs have been thoroughly studied (Al-Natour, et al., 2006; 2008; Komiak and Benbasat, 2006; Wang and Benbasat, 2005; 2007; etc.). However, our understanding of users' trusts in second-generation AGSs is in its infancy. Most of the existing research about second-generation AGSs are conducted from a technical perspective, focusing on how to design better algorithms in order to generate higher quality advice. Very few studies, the topics of which are related to users' perceptions on such systems, only roughly mention the potential trust risks due to the unique features of such systems and stay at the theoretical level. Hardly any empirical studies can be found in the literature. We argue for the necessity of studying users' trusts in second-generation AGSs because users may feel second-generation AGSs are less controllable and less transparent than first-generation ones due to the implicit elicitation of user needs and high complexity of advice-generating algorithms in second-generation AGSs. Accordingly, influential factors of users' trusts in second-generation AGSs may also be different from those in first-generation ones.

Based on the literature, we picked out trust antecedents that were once studied in the context of second-generation AGSs. We found that researchers who studied trust antecedents of second-generation AGSs mainly focused on calculative reasons, interactive reasons, and know-based reasons. The trust antecedents they studied are either unique to second-generation AGSs or more important in the context of second-generation AGSs than that of first-generation AGSs. Accordingly, we proposed design suggestions for trustworthy second-generation AGSs. In order to increase users' trusts through affecting calculative reasons, we suggest that second-generation AGSs should be designed with intelligence high enough to keep bringing users "pleasant surprise" – recommendations that they have never thought of but will fall in love with at the first glimpse. We also suggest second-generation AGS designers to provide clear instructions about: a) what kind of user information they collect; b) when, how, and why they collect such information from users; and c) how they will use the collected information; and d) structural assurance that can ensure the privacy and security of users' input data. In order to increase users' trusts through affecting calculative reasons, we suggest designers create sufficient opportunities for users to provide feedbacks for previously generated advice to AGSs (e.g. whether users like the advice, why do users like/dislike the advice, etc.). In addition, we suggest designers create interfaces for human intervention when developing second-generation AGSs. In order to increase users' trusts through affecting knowledge-based reasons, we suggest designers indicate the input used for advice-generating process, use plain words to explain the complex advice-generating techniques, and avoid giving non-specific explanations such as "Here are recommendations for you".

Our research makes contributions in both academic and practical field. Unlike existing research focusing on the design AGS algorithms, we studied trust, a crucial factor of successful adoptions of such AGS technologies. To the best of our knowledge, our research is one of the first to systematically study trust issues on second-generation AGSs in the IS field. As for practical contributions, this paper helps system designers better develop second-generation AGSs by proposing detailed design suggestions.

Keywords: Trust, Trust antecedent, Second-generation advice-giving system, First-generation advice-giving system, Design suggestion.

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HOW AIRBNB CONVEYS SOCIAL AND ECONOMIC VALUE THROUGH USER REPRESENTATION

Research paper

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Abstract

New platforms for renting and sharing among private individuals are emerging in today's e-commerce landscape. Airbnb can be regarded as a representative of many such platforms. Such accommodation rental commonly implies shared usage where both host and guest occupy a space at the same time, involving social interactions that can provide additional value. Drawing on social reward theory, this paper proposes a research model that links the guest's intention to book to the host's user representation via the pathways of social and economic value. We propose a design to evaluate our research model by means of a scenario-based online experiment, including the common elements of user representation (1) text reviews, (2) profile information (e.g., occupation, hobbies and interests), (3) star rating, and (4) the listing price. With this, we expect to contribute to a better understanding of the driving factors behind guests' booking decisions in accommodation sharing.

***Keywords**: Airbnb, booking intention, social value, user representation.*

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1 Introduction

New marketplaces are emerging in today's e-commerce landscape (Karlsson et al. 2017). While traditional C2C platforms facilitate the exchange of products among peers, a continuously growing number of platforms now renders renting and sharing schemes among private individuals possible (Sundararajan 2016). Airbnb – the posterchild example for peer-to-peer accommodation sharing – can be regarded as a representative of many such platforms. Despite Airbnb's similarity to traditional e-commerce platforms, it also differs distinctively in several fundamental ways. First, most listings are run by private individuals and hence guests face higher levels of economic exposure if the worst comes to the worst (e.g., being stranded in a foreign country), compared to more accountable corporate hospitality providers. Consequently, correctly assessing one's potential host is essential. Second, the offered accommodation commonly implies shared usage where both host and guest occupy a space at the same time (Teubner et al. 2017). Such shared-usage scenarios commonly involve social interactions that can provide additional value (or intricacies) for guests by enhancing overall trip experience (Hawlitschek et al. 2016; Ikkala and Lampinen 2015; Möhlmann 2015). As co-usage is not offered by traditional hotel brokers at all, accommodation sharing platforms promote personal aspects explicitly (Airbnb 2014, 2016a; Homestay 2017).

The duality of social and economic aspects in the creation of value to the guest renders transactions on Airbnb highly dependent on the host's user representation. In particular, the question emerges whether and if so, how, a potential guest's decision to book an apartment with a specific host depends on the host's overall online appearance (Ert et al. 2016; Fagerstrøm et al. 2017; Ma et al. 2017). Against this backdrop, we link the guest's intention to book to the host's user representation via the pathways of social and economic value. First, economic value refers to potential savings by booking via Airbnb as compared to traditional modes of consumption (i.e., hotels, hostels). Likewise, expectations of organizational overhead may reduce economic value. Second, the relevance of social value suggests that a guest's intention to book is also driven by prospective (positive or negative) social interactions (Fareri and Delgado 2014; Sanfey 2007). In contrast to B2C e-commerce and traditional C2C platforms such as eBay, real-world social interactions represent an integral part of co-usage sharing. Also, we suggest that accommodation sharing represents a particular interesting example in view of social facets, since the expected personal interactions are quite strong (as compared to, for instance, ride sharing).

In this paper, we hence consider a research model of a guest's view on a prospective accommodation sharing transaction. Based on social reward theory (Fareri and Delgado 2014; Krach et al. 2010), we consider how common artefacts of host representation affect potential guests' perceptions and booking intentions. We sketch out a design to evaluate our research model by means of a scenario-based online experiment. Participants take the role of a guest and consider an apartment offer by a (non-professional) host. Our experiment design comprises four common elements of user representation which are varied based on a full-factorial treatment design, including the dimensions (1) text reviews, (2) profile information (e.g., occupation, hobbies), (3) star rating, and (4) the listing's price.

The contribution of the outlined research is twofold. First, we enable a better understanding of the driving factors of guest decisions in accommodation sharing. In addition to expected *economic* value, we illustrate that such decision processes are also governed by expectations of *social* value. Second, drawing upon the literature on text sentiment analysis, we illustrate how different gradations of tonality contribute to forming booking intentions – and how this prevalent aspect of P2P platforms interacts with other factors such as textual profile information, prices, and star ratings.

The remainder of this paper is structured as follows. In the next section, we locate our study within the sharing economy literature, develop the theoretical foundation for our research model, and, based on this, derive our research hypotheses. We then present the blueprint for a scenario-based online experiment including treatment design, stimulus materials, and measurement instruments. Last, we discuss expected findings, practical and theoretical implications, as well as limitations of our study's approach.

2 Theoretical Background and Research Model

The sharing economy experiences vigorous growth and consequently attracts increasing scientific attention. Previous research has focused mainly on two prime domains, namely mobility (Cohen and Kietzmann 2014; Teubner and Flath 2015) and accommodation sharing (Ikkala and Lampinen 2015; Karlsson et al. 2017; Tussyadiah and Pesonen 2016a). While there have been identified numerous motives for consumers to engage on sharing platforms (e.g., economic, social, sustainability-related, or anti-capitalistic considerations), economic and social motives are commonly considered as prevailing (Edbring et al. 2016; Hawlitschek et al. 2016; Ikkala and Lampinen 2015). Hence, beyond economic aspects, providers can leverage expectations of social value to market their products, services, and – ultimately – themselves. Given the high intensity and intimacy of social interaction in accommodation sharing, the interplay of economic and social factors is particularly interesting within this rapidly developing domain. In order to capture the important role of social (beyond economic) motives, social reward theory lends itself as an overarching framework to guide hypotheses development.

2.1 Social reward theory and text sentiment

Social reward theory posits that the general principle of maximizing expected outcomes – beyond economic factors – comprises social factors too (Fareri and Delgado 2014; Sanfey 2007). Engaging in rewarding interpersonal interactions has always been an important factor in the continuation of the human species (Tamir and Ward 2015). Consequently, the human brain has developed a variety of processes that reward us when engaging in social activities (Kelley and Berridge 2002; Tamir and Ward 2015). Krach et al. (2010), for instance, found that some of the most potent rewarding stimuli to humans can be obtained by experiencing positive social interactions and, in this vein, Fogg (2009, p. 4) argued that "[t]he power of social motivation is likely hardwired in us." In line with that, Jiang et al. (2013, p. 582) referred to social reward as "the pleasure, satisfaction, and gratification individuals derive from participating in interpersonal interactions." It can be obtained by a variety of activities, including meeting interesting people of diverse cultural backgrounds (Ikkala and Lampinen 2015), positive emotional expressions (Rademacher et al. 2010), mutual cooperation and fairness (Lieberman and Eisenberger 2008; Sanfey 2007), peer approval and friendly gestures (Bhanji and Delgado 2014), communication (Krach et al. 2010), or by others' mere attention or social approaches (Buss 1983).

In this view, text-based communication has historically been an important means to establish and maintain interpersonal interaction. Assessing a text from a social and emotional perspective is hence a human key capability. In this regard, text sentiment refers to the quantification of a text's positive or negative tonality which is derived from the connotation and constellation of the contained words.

Social value and text sentiment both apply to transaction processes within co-usage sharing. As we outline in this paper, the interplay of prospective social value and text is associated with many steps of peer-based accommodation sharing and accompanies the entire process life cycle from search (textual elements on host profiles), initial booking requests (text messages), to post-transactional reviews (text-based). Moreover, platform providers deliberately place social cues to stimulate expectations about social value.

2.2 Research model

As stated above, previous research has identified different motives for participating in sharing *in general*. Among other things such as ecological sustainability and altruism (Hellwig et al. 2015; Leismann et al. 2013; Tussyadiah 2015), intention to purchase from a *specific* provider is likely to be guided by the consumer's perception of the provider – expressed through the respective user representation. We argue that a consumer's purchase intention is driven by the inferences he or she makes on the respective transaction's social and economic value. This yields the research model as depicted in Figure 1 for the case of accommodation sharing as a specific instance of co-usage sharing where the social interactions are expected to be stronger than other co-usage scenarios (e.g., ride sharing). Our underlying hypotheses link the platform's interface design variables of the host's user representation to the guest's

intention to book via two main paths of expected social value and expected economic value (Fareri and Delgado 2014; Krach et al. 2010). We develop our hypotheses in the following.

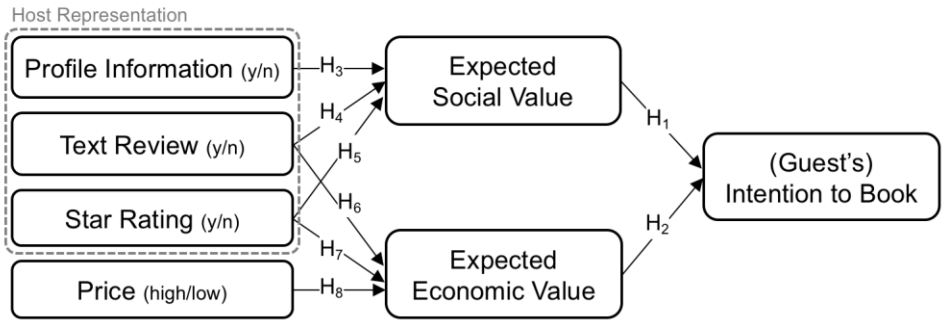

Figure 1. Schematic Research Model.

2.3 The influence of expected social and economic value on the guest's intention to book (H_1, H_2)

Based on the notion of social value, a guest's purchase intention may – beyond economic motives – be founded on expectations of positive social interactions (Hamari et al. 2016; Hawlitschek et al. 2016; Ikkala and Lampinen 2015). In a prospective transaction, the anticipation of co-usage particularly promotes such social aspects by providing opportunities for meeting interesting people or engaging rewarding interpersonal communication (Ikkala and Lampinen 2015; Krach et al. 2010). Consequently, platform operators actively emphasize and advertise such social aspects, for instance, by holding out the prospect of traveling and experiencing the foreign places "like a local" (Airbnb 2016a), or by providing a sense of belonging around the world (Homestay 2017). The literature has established that social motives represent a strong driving force of consumer behaviour and decisions in the domains of electronic commerce (Chen et al. 2017; Jiang et al. 2013) as well as hospitality and tourism (Guttentag et al. 2017; Hawlitschek et al. 2016; Tussyadiah and Pesonen 2016b). We thus suggest that guests may be more inclined to book an accommodation with a certain host, because they believe that it would be worth it *socially*. Our first hypothesis states:

H_1: *A higher level of expected social value increases a potential guest's intention to book.*

Besides this novel aspect of peer-based accommodation services, economic considerations still represent the single most important factor for the formation of booking intentions (Guttentag et al. 2017; Hawlitschek et al. 2016; Ikkala and Lampinen 2015; Tussyadiah and Pesonen 2016b; Wang and Nicolau 2017). Taking a guest's perspective, economic value refers to the guest's overall perception that a transaction is worth it *economically*, which entails (at least) two aspects. First, depending on a listing's price, a peer-based accommodation may simply be – and often is – less expensive than an alternative comparable mode of consumption (e.g., a hotel; Guttentag 2015; Zervas et al. 2013). It is undisputed that such potential net benefits guide choices towards the less expensive alternative. Second, expectations of economic impairments, for instance due to financial losses (e.g., non-refunded deposits, hidden extra costs), additional organizational efforts and uncertainties (e.g., need for circumstantial personal messaging, waiting for host responses), and possible hassles along the process (e.g., late or no shows, lower-than-expected apartment quality), are likely to result in decreased booking intentions, where prospective losses typically outweigh prospective saving (Kahneman and Tversky 1979). In summary, expected economic value emerges as a potent driver of booking intentions in peer-to-peer accommodation sharing.

H_2: *A higher level of expected economic value increases a potential guest's intention to book.*

2.4 The influence of profile information, text reviews, and star rating on expected social value (H_3–H_5)

Platform operators provide several features to promote prospective social value through social cues. One of them is the profile information section. Hosts are encouraged to disclose information regarding, for instance, their occupation, hobbies and interests, or a life motto (see Figure 2). By selecting the amount and type of information they want to share, hosts determine their way of self-presentation individually (Hong et al. 2012). Disclosing such information draws a more vivid picture of the particular person and hence provides additional value for guests as they may help to perceive that the prospective transaction partner is a real, multifaceted human being. Thereby, hosts can induce feelings of connectedness and intimacy by increasing liking and understanding (Altman and Taylor 1973; Janssen et al. 2014).

H_3: *The availability of profile information (regarding the host) increases a potential guest's expected social value.*

The presence of user-generated reviews represents a common design feature in today's e-commerce applications. Cui et al. (2012, p. 45) outlined that "positive reviews by other consumers are indicative of a product's quality and reputation." In the context of platforms with informational asymmetry, such text-based evaluations of users' experience remain the most prevalent and influential form of assessment (Chatterjee 2001; McKnight et al. 2002a, 2002b). This particularly applies for hospitality where users prefer feedback from other guests over information posted by travel agencies (Chen and Xie 2008; Gretzel and Yoo 2008). The effect of user reviews depends on their tonality, which can be quantified by a sentiment score. Bae et al. (2017) showed that travellers on Airbnb tend to share their experiences more often if the trip experience deviates from a neutral baseline. Therefore, the presence of a positive review can be seen as a signal of prospective above-average trip experience. Because the overall trip experience comprises social interactions with the host, our next hypotheses states:

H_4: *The availability of a positive text review (regarding the host) increases a potential guest's expected social value.*

Beside text reviews, star ratings represent a popular means of assessment. Typically, hosts and guests mutually rate each other once a transaction is completed (without knowing the other party's assessment; Fradkin et al. 2017). In the context of Airbnb, for instance, those star ratings act as a reputation system, which represents an important source of information for guests to choose listings (Luca 2016). Ratings vary between 1 and 5 stars (with a displayed precision of 0.5 stars) and Airbnb encourages guests to evaluate their experience (Airbnb 2016b). The platform even encourages hosts to actively ask for reviews and feedback after each transaction (Airbnb 2017). A host's average star rating score represents a quantification of overall (past) experience quality, and hence serves as a quality signal for prospective guests. Because the overall experience comprises social interactions, we consider a positive star rating as a signal for prospective social value. H5 thus states:

H_5: *The availability of an excellent star rating (regarding the host) increases a potential guest's expected social value.*

2.5 The influence of text review, star rating, and price on expected economic value (H_6–H_8)

In the context of Airbnb, expected economic value is characterized by the potential economic value of a stay in terms of utility, quality, and benefits balanced with monetary and non-monetary costs (Liang et al. 2016). Non-monetary costs include the time and effort for organizing a stay, risks association with booking online (Ponte et al. 2015), and potential complications along the process. Perceived risk increases with uncertainty and the magnitude of imaginable negative consequences (Kim et al. 2008). Due to the service character of Airbnb stays, guests can only estimate the risk of transactions upfront by judging available information and pre-trip communication. Positive electronic word-of-mouth in the form of advice provided through the online community was found to create trust in the hosts and to significantly reduce guests' perceived risk by reassurance of not being deceived (Liang et al. 2016).

Hence, expected economic value is influenced by assessments of other guests, priorly having engaged with a particular host (Bae et al. 2017). Such assessments can be seen on Airbnb in the form of text reviews. Abramova et al. (2017) reveal that guests are willing to pay more for positively reviewed listings. Thus, text reviews can be expected to play an important role for assessing economic value. Moreover, authentic positive reviews can emphasize additional benefits provided by the host and increase the perceived value of the stay. Overall, we propose that:

H_6: *The availability of a positive text review (regarding the host) increases a potential guest's expected economic value.*

In addition to text reviews, average star ratings displayed on a host's profile page commonly refer to host-guest interaction. Due to inflated star ratings on P2P platforms (Slee 2013; Zervas et al. 2015), most hosts exhibit either excellent (4.5 or 5.0 stars) or no star ratings at all, which is the case as long as the host has accommodated less than three guests (Gutt and Herrmann 2015). Based on this, the absence of a star rating can be mostly attributed to a host's inexperience and should hence lead to greater perceived risk due to uncertain organizational proficiency. The economic impact of a host's track record was demonstrated by Gutt and Herrmann (2015), showing that hosts increased their listing prices once ratings became visible. This is consistent with results by Ikkala and Lampinen (2014, 2015) and Edelman and Luca (2014), who find that Airbnb hosts leverage their reputational capital based on rating scores to set higher prices. In light of the notion of uncertainty reduction, we suggest that (excellent) star rating availability induces trust in a host's capability and hence promotes potential guests' expectations of economic value. Formally:

H_7: *The availability of an excellent star rating (regarding the host) increases a potential guest's expected economic value.*

Last, a listing's price directly determines a guest's (monetary) costs when deciding to book. It needs to be balanced with the listing's value to estimate expected economic value. Möhlmann (2015) showed how cost savings not only have a positive effect on perceived value but also on overall guest satisfaction and intention to choose a sharing option again. In contrast, higher prices decrease perceived value – especially if they differ greatly from what is perceived as adequate (Gutt and Kundisch 2016). In fact, a higher price can often be seen as a signal for premium quality. Considering a standard accommodation with no cues for special amenities whatsoever, the posted price primarily represents cost and can hardly be employed as a signal of quality. Thus, when differentiating price levels, everything else equal, lower prices are likely to increase economic value.

H_8: *A lower listing price increases a potential guest's economic value as compared to a higher listing price.*

3 Experiment Design

To evaluate our research model, we seek to employ a scenario-based online experiment. The scenario is placed in an accommodation sharing setting similar to Airbnb. In the following, we outline the details of the scenario, treatment design, stimulus material, procedure, and the employed measures. In the experiment, each participant takes on the role of a potential guest, considering to book a given accommodation listing. Once participants have read the scenario description, they are forwarded to a page on which they see the (prospective) host's profile page. Importantly, the apartment's specific properties are described with a minimum of detail and identically across all treatments.

3.1 Treatment design and stimulus material

The experiment constitutes a 2 (profile information displayed: yes, no) × 2 (star rating displayed: yes, no) × 2 (text review displayed: yes, no) × 2 (price: high, low) between-subjects full-factorial design. Hence, each participant only takes part in one of a total of $2^4 = 16$ treatment conditions. Moreover, we employ a balanced design with regard to the hypothetical host's gender, where female and male hosts are equally likely. An example sketch of the host representation is provided in Figure 2. The four design variables are highlighted in orange.

Profile information (1): Participants either see no profile information at all (50% of all cases) or a brief description of the potential host, comprising typical information for accommodation sharing such as occupation, list of hobbies and interests (Ma et al. 2017). Consequently, the profile information is compiled randomly from predefined sets of common occupations (e.g., education, marketing, medicine) and common interests and hobbies (e.g., photography, volleyball, textile design).

Text review (2): Participants either see no text review (50% of all cases) or a positive text review. Alike profile information, the text review is randomly drawn from a set of typical, text-based assessments of hosts and overall trip experience. These reviews are obtained from actual Airbnb hosts, then anonymized and edited in terms of grammatical and orthographic correctness and language.

Star rating (3): Participants either see no star rating at all (50% of all cases) or one out of the two (positive) rating conditions of 4.5 or 5.0 stars. Star ratings on Airbnb are subject to a skewed distribution. 54.6% of listings have not yet received their star rating yet and 40.6% have either 4.5 or 5 stars (Ke 2017; Zervas et al. 2015). Our treatment design is aligned towards this distribution.

Price (4): Participants either see a high (50% of all cases) or a low price. We use $108 as low and $187 as high value, representing the 25- and 75-percentile of the price distribution for a typical booking (private room, two nights, including cleaning fee; Teubner et al. 2017).

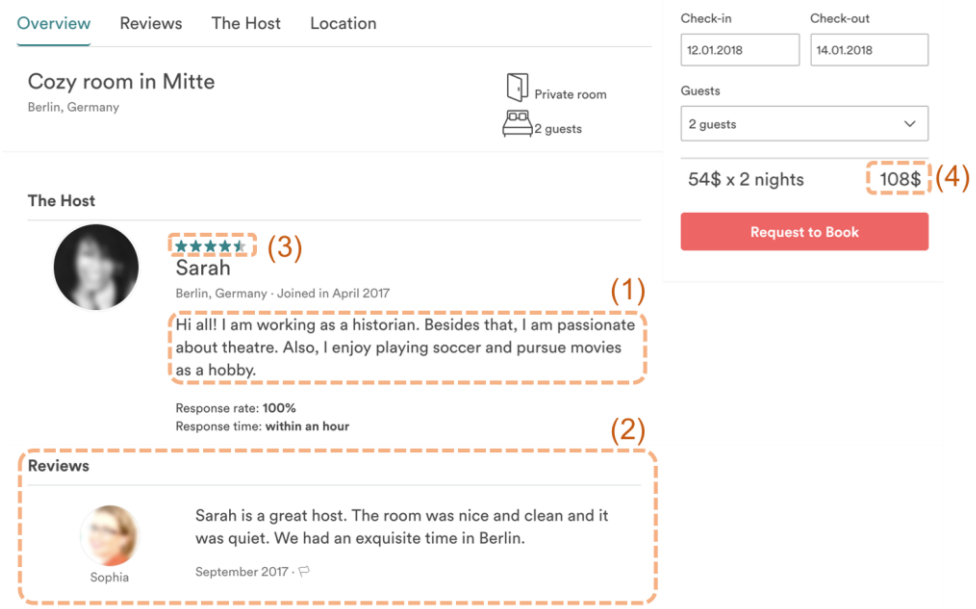

Figure 2. Example screenshot of user interface with indications of treatment elements (1-4).

With regard to all other elements of host and apartment representation, we seek to display as few pieces of information as possible in order not to direct attention to such – within the scope of this research – secondary aspects. In particular, this includes the host's profile image, for which we use blurred pictures. Host names are picked randomly from a set of common first names. Beyond price, accommodation properties such as the availability of amenities, exact location, booking- and cancellation policies, and so forth are not displayed.

3.2 Measures

Whenever possible, and to ensure content validity, previously validated scales are used and adapted to the context of this study. Items for the (guest's) intention to book are adapted from Gefen and Straub (2003), expected economic value from Kim et al. (2007), expected social value from Jiang et al. (2013). All items are measured on 7-point Likert scales. In addition to the constructs directly related to the research model, we collect demographic and trait information as control variables, including age, gender, experience with Airbnb, individual risk propensity (Dohmen et al. 2011), and disposition to

trust (Gefen 2000). Moreover, additional factors such as trust in host (Gefen and Straub 2003), perceived social presence (Gefen and Straub 2004), and perceived host-guest similarity (Reichelt et al. 2014) are collected and may serve as mediating variables in additional analysis.

4 Discussion and Conclusion

With the outlined research, we intend to contribute to a better understanding of the guest's view on accommodation sharing in general and specific listings and hosts in particular. By validating our research model through the proposed scenario-based online experiment, we pursue the following contributions to the information systems literature. First, we explain a potential guest's booking intention by linking it to the host's user representation via the paths of social and economic value. By quantifying the influences of these two determinants and contrasting them against each other, we expect to reveal their relative weights in the booking process. Ultimately, this should result in a better understanding of consumer decisions in peer-based accommodation sharing and hence guide the (self-) marketing strategies of resource providers in peer-to-peer sharing. Second, we determine the effects of common user interface artefacts such as profile information, text reviews, and star ratings on booking intentions, specifying the importance of such elements as facilitators of prospective host-guest interactions. This may inform platform operators as well as users for designing, operating, and using peer-to-peer platforms.

Given Airbnb's current attempt to broaden its business model beyond pure accommodation sharing (e.g., offering guided tours provided by locals, Airbnb 2016a, 2016c), we expect the interplay of social and economic value to increase in importance. Compared to, for instance, sharing a ride for a few hours, accommodation sharing exhibits much greater social intensity. Obviously, staying with a host for a weekend or longer involves high levels of intimacy abandonment. Such experiences certainly vary depending on whether the host is actually present during the stay (on-site host) or only for key exchange (off-site host). Examining whether and under which conditions our findings can be generalized to explain consumer behaviour in other domains of co-usage sharing hence represents a natural next step. Our study approach has several further limitations. First, a consumer's actual decisions in accommodation sharing may vary from the stated perceptions and intentions within online experiments. To mitigate such effects, our experiment design portrays an actual booking situation as realistically as possible. Hence, both structure and the visual impression of the booking process are guided by the "look and feel" of popular accommodation sharing platforms. Further, for the sake of brevity, the layers of trust (i.e., the guest's confidence that her vulnerability will not be exploited by the host; Cyr et al. 2009) and perceived social presence (i.e., the degree to which a medium allows a user to experience others as being psychologically present, Fulk et al. 1987) are not explicitly included in our research model. We anticipate these constructs to serve as important mediators for explaining the effects of host representation on social and economic value as well as booking intentions.

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INCREASING INFORMATION VISUALIZATION COMPLIANCE IN SELF-SERVICE BUSINESS INTELLIGENCE WITH USER ASSISTANCE SYSTEMS

Research Paper

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Abstract

Self-Service Business Intelligence (SSBI) is increasingly used in organizations. While enabling laypersons in report design to create their own reports in a timely manner, studies show that Business Information Visualization (BIV) is often inappropriately applied in these reports. This may lead decision makers to wrong conclusions. As a result, companies start to establish BIV governance frameworks, which employees are expected to comply with when designing reports. For this, they often provide employees with documentations about which guidelines to comply with. However, since employees may perceive this as additional effort with limited benefit, they may opt to simply not comply. If they are instead equipped with software that provides the functionality to comply, this software often lacks a description of the benefits of this compliance. To overcome this, user assistance systems (UAS) could be used, since they may both reduce the effort to comply as well as describe the usefulness of compliance. To investigate this issue, we developed a prototypical UAS for BIV, suggest a design for a laboratory experiment, and present findings from a first preliminary study. Results indicate that using UAS for BIV may lead to increased perceived ease of use and perceived usefulness of complying with BIV guidelines.

Keywords: User Assistance Systems, Business Information Visualization Guidelines, Compliance, Self-Service Business Intelligence, Design Science Research.

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1 Problem Identification and Research Objective

To design business reports, Self-Service Business Intelligence (SSBI) is increasingly utilized in organizations (Bange *et al.*, 2017). Here, laypersons in report design (e.g., business users) may use multiple features (e.g., visualizations) to develop their own business reports in a timely manner and share them with decision makers (Poonnawat and Lehmann, 2014). Due to their lack of report design knowledge, however, they often do not correctly apply Business Information Visualization (BIV) within their SSBI reports (Eisl *et al.*, 2015; Beattie and Jones, 2008), which leads to wrong impressions due to a distorted perception (Arunachalam *et al.*, 2002). Thus, decision makers who receive and rely on these delusive business reports may be misled and conclude inappropriately (Arunachalam *et al.*, 2002; Beattie and Jones, 2008). To avoid these negative outcomes, approximately 75% of companies strive

for a standardized reporting (Riedner and Janoschek, 2014). In doing so, they often establish BIV governance frameworks in the organization, which employees are expected to comply with when designing business reports (Bange *et al.*, 2017; Gluchowski, 2014; Russom *et al.*, 2015). For this, they often provide employees with documentations about which guidelines to comply with. However, since employees may perceive this as additional effort with limited benefit, they may opt to simply not comply (Riedner and Janoschek, 2014). If they are instead provided with software that provides the functionality to comply, this software often lacks a description of the benefits of this compliance (e.g., Chart-me XLS (Gerths, 2018)), which in turn may reduce the intention to comply with BIV guidelines. Possible consequences of this lack of assistance with complying and explaining benefits of compliance are frustration and low efficiency of employees, resulting in overall dissatisfaction (Coch and French, 1948).

It is hence imperative to strive for a solution that makes it both easy for employees to comply with BIV guidelines and raises their understanding of the usefulness of complying with them at the same time. Due to their various applications, a promising approach to achieve these goals is the use of user assistance systems (UAS) (Ludwig, 2015). They help users to perform their tasks better (Maedche *et al.*, 2016) and hence, may increase the perceived ease of use of complying with BIV guidelines. In addition, when UAS are equipped with informative explanations as to why suggestions are made, they may raise an understanding of the perceived usefulness of complying with BIV guidelines (Morana *et al.*, 2017). According to the technology acceptance model (TAM) introduced by Davis (1986), this may in turn lead to an increased intention to comply with BIV guidelines.

In this study, we hence introduce a design science research (DSR) project that aims to develop a UAS that supports employees in complying with BIV guidelines. During the first design cycle, we focused on describing the development of a prototypical artifact, the "BIV Assistant" (Schelkle, 2017). With this current study, we aim to investigate how UAS for BIV may affect the intention to comply with BIV guidelines in management reporting. Having conducted a systematic literature search, based on our sample, we could not identify prior research that explicitly concerns questions whether UAS may actually foster the intention to comply with guidelines (see section 2). Therefore, we set out to evaluate a prototypical UAS for BIV to answer the following research question:

RQ: To what extent do UAS affect the intention to comply with BIV guidelines in management reporting, in particular in an SSBI environment?

To achieve this, we aim to evaluate this prototypical UAS for BIV in a laboratory experiment. Herewith, we follow the call of Maedche *et al.* (2016) to study the effects of UAS in the information systems (IS) domain. This research suggests an experimental design for our planned evaluation and provides findings from a preliminary study.

The remainder of this paper is structured as follows. Section 2 discusses related work followed by the terminology and theoretical background in section 3. Section 4 briefly describes the functionality and design of the artifact. The experimental setting and first evaluation results are presented in section 5. The paper closes with a conclusion and outlook for future research possibilities.

2 Related Work

To see whether UAS are used to foster acceptance of and intention to comply with guidelines, knowledge and solutions from prior literature have to be discussed (Peffers *et al.*, 2007). Hence, we conducted a structured literature review drawing on the taxonomy of Cooper (1988) (see Table 1).

Focus	Research Outcomes	Research Methods	Theories	Applications
Goal	Integration	Criticism	Central Issues	
Perspective	Neutral Representation	Espousal of Position		
Coverage	Exhaustive	Exhaustive & Selective	Representative	Central/Pivotal

Organization	Historical	Conceptual	Methodological

Table 1. Taxonomy of Literature Reviews proposed by Cooper (1988)

We *focus* on the identification of research outcomes on compliance with guidelines by using UAS as applications. The *goal* is to identify central issues in prior research that investigate UAS, which are used to affect the intention to comply with predefined BIV guidelines. Since our aim is to identify existing UAS, which evaluate the intention to comply with guidelines, we adopt a neutral *perspective*. Focusing on UAS as well as BIV as central aspects, we follow a *pivotal* approach. The search is *organized* conceptually, i.e., studies addressing the same idea, UAS used for compliance, appear together.

Since studies related to BIV are fundamentally multidisciplinary (Ware, 2004), we included literature from prior research in computer science and human visual perception (IEEE Xplore and ScienceDirect) as well as business and management (Emerald Insight) in our literature search. To reflect the AIS Senior Scholars' Basket of Journals and important conference proceedings in the IS field, we added the AIS Electronic Library. To complement the search, we included specific management accounting and IS journals (i.e., HMD Praxis der Wirtschaftsinformatik, Journal of Management Accounting Research, Journal of International Financial Management, and Accounting and Management Accounting Quarterly). We conducted a keyword search comprising title, abstract, and keywords applying the search term *"User Assistance System" OR "User Assistant" OR "User Support System" OR "Assistenzsystem"* to reveal literature in the above-mentioned outlets. As a result[1], *49* articles that deal with UAS could be identified. These range from assistance in healthcare (e.g., Henkemans *et al.* (2006)) and ambient assisted living (e.g., Schneider *et al.* (2016)) to education (e.g., Carlier and Renault (2010)) and many more. However, only one article is related to the information visualization domain and discusses a UAS that suggests to users different mappings between their data and possible visualizations (Guettala *et al.*, 2012). Although this study shows the potential of using UAS for BIV, compliance with specific BIV guidelines is not addressed. Since we could not identify literature that addresses UAS and compliance directly, we chose to draw on aspects of acceptance, which might indicate compliance characteristics to some extent. Six out of the 49 articles are related to acceptance. Four articles present technological aspects of acceptance, such as the importance of dialogues (Henkemans *et al.*, 2006), the acceptance of augmented reality (Bleser *et al.*, 2011), the acceptance of smart watches versus mobile phones among dementia patients (Schneider *et al.*, 2015), or pilots accepting a new cockpit assistance system due to its features (Onken and Walsdorf, 2001). The remaining two articles discuss an algorithm for a lecture allocation system at a university, in which students may accept the assigned lecture (Matsuo and Fujimoto, 2005a, 2005b).

As a result, although some papers address aspects of acceptance, we could neither identify studies that discuss UAS with a focus on compliance in general, nor how UAS may affect the intention to comply with BIV guidelines. Although there might be relevant publications in other outlets, we suppose that our literature review has a satisfying degree of comprehensiveness, since researchers argue that a search can be terminated when the authors are confident of the novelty of the identified area (Boell, Sebastian K. and Cecez-Kecmanovic, 2010). Hence, we claim that our search shows a research gap that we intend to bridge with our study.

3 Terminology and Theoretical Background

When information visualization technologies are used to visualize business information (e.g., charts or tables) it is referred to as BIV (Tegarden, 1999). Hence, BIV is the use of computer-supported interactive visual representations of business data to amplify cognition for improved decision making (Bačić and Fadlalla, 2016, p. 78). This involves defining graphical elements and their relationships to display relevant information (Al-Kassab et al., 2014).

[1] Due to length limitations, we are not able to list all identified references. The list can be provided upon request.

To establish a theoretical underpinning for how UAS might affect the intention to comply with BIV guidelines, we may first look at previous work on compliance in IS literature. A domain within IS that strongly focuses on user compliance is security, as there are many security policies that employees are expected to comply with in order to prevent organizations from potentially dire consequences (Bulgurcu *et al.*, 2010). In this context, it is argued that when it comes to an individual's decision whether to comply with such policies, they take into account both the benefit of complying with the policy as well as the cost of complying with the policy (Bulgurcu *et al.*, 2010). The reasoning for this is rooted in rational choice theory that posits that individuals take these parameters into account for any decision at hand (Paternoster and Pogarsky, 2009; McCarthy, 2002). Hence, in our context, individuals might also trade off their personal benefit of complying with BIV guidelines as well as the effort caused by complying with these guidelines. According to the theory of planned behavior, this has an effect on their attitude towards complying with BIV guidelines which in turn may influence the intention to comply with BIV guidelines (Fishbein and Ajzen, 1975; Ajzen, 1991). Additional important constructs that affect the intention to comply with security policies are self-efficacy to comply and normative beliefs (Bulgurcu et al., 2010). Self-efficacy to comply describes whether individuals believe they have the abilities and knowledge to comply with the policies whereas normative beliefs express social pressure to comply with these policies. Again, in our context, we expect to observe effects of self-efficacy with regard to complying with BIV guidelines as well as social norms that urge individuals to comply with BIV guidelines.

A prominent theoretical framework that ties these streams of thought together is the TAM (Davis, 1986). It postulates that an individual's intention to use a system (or in our case to comply with BIV guidelines) is determined by perceived usefulness and perceived ease of use (Davis, 1986). Perceived usefulness is defined as the extent to which a person believes that using a particular system will enhance job performance (Davis, 1986), which might in our case be interpreted as the benefit individuals expect from complying with BIV guidelines. The degree to which a person believes that using a particular system will be free of physical and mental effort is defined as perceived ease of use (Davis, 1986), which in our case refers to the individual's cost or effort of complying with BIV guidelines. Thus, when perceived ease of use (i.e., little effort to comply with BIV guidelines) and perceived usefulness (i.e., benefits from complying with BIV guidelines) are high, individuals have a high intention to use a system, or in our case, intention to comply with BIV guidelines.

One promising approach to increase the aforementioned antecedents of the intention to comply with BIV guidelines is using UAS. They guide users (e.g., management accountants) while performing a specific task (e.g., designing business charts) (Maedche *et al.*, 2016), thus fostering perceived ease of use of the task at hand. Since UAS provide guidance or advice on a topic (Maedche *et al.*, 2016), for example on how to adequately apply BIV, they might also foster perceived usefulness of complying with BIV guidelines, as the reason why to use them and what benefits this compliance might have are shown. In addition, this may foster self-efficacy about how to appropriately design business reports. Since SSBI users are at some point novices in report design, they are likely to have a low reporting-related self-efficacy (i.e., the belief in one's capabilities to organize and execute the courses of action required to manage prospective situations (Bandura, 1995)) to design non-misleading reports. Hence, we also investigate how UAS may increase their perceived BIV related capabilities and thus their self-efficacy. Although normative beliefs in general play a role for the intention to comply with BIV guidelines, we do not expect a UAS for BIV to influence social pressure to comply with BIV guidelines, as accepting the system's recommendations is the users' decision. We hence propose the following hypotheses:

H1: Using UAS for BIV increases the intention to comply with BIV guidelines.

H2: Using UAS for BIV increases the perceived usefulness of complying with BIV guidelines.

H3: Using UAS for BIV increases the perceived ease of use of complying with BIV guidelines.

H4: Using UAS for BIV increases reporting-related self-efficacy.

In line with the propositions introduced in the TAM, we also expect to see positive relationships between the intention to comply with BIV guidelines and its antecedents. We thus propose:

H5: There is a positive relationship between the perceived usefulness of complying with BIV guidelines and the intention to comply with BIV guidelines.

H6: There is a positive relationship between the perceived ease of use of complying with BIV guidelines and the intention to comply with BIV guidelines.

H7: There is a positive relationship between reporting-related self-efficacy and the intention to comply with BIV guidelines.

To investigate these hypotheses, we will propose an experimental design as well as results from a preliminary study in section 5. First, we will briefly describe the functionality and design of the artifact.

4 Functionality and Design of the Artifact

4.1 Desired Functionality

The desired functionality of our UAS called "BIV Assistant" is divided into three steps (Schelkle, 2017). First, it screens business charts for inadequate BIV. This might for example be a truncated axis that exaggerates the magnitude of a trend. Second, a warning is prompted to the user that explains the visual deficiency according to BIV guidelines from the International Business Communication Standards (IBCS) Association. These guidelines describe how to assure appropriate BIV, referring to prominent information visualization literature (Hichert and Faisst, 2015). In consequence, users may perceive adequate BIV as being useful to support decision making, thus fostering perceived usefulness of complying with BIV guidelines. Last, the user decides if the BIV Assistant automatically amends the inadequate BIV by applying the guideline presented in the previous step. Since complying with BIV guidelines in this case is reduced to the click of a button, it may result in increased perceived ease of use. According to the TAM, this may lead to an increased intention to comply with BIV guidelines.

The current prototype of the BIV Assistant detects four different misleading visualization patterns (i.e., truncated axis, inverted timeline, filtered elements on the ordinate axis, and differently scaled axes) (Schelkle, 2017). This refers to Courtis (1997) as well as Beattie and Jones (2008) who examine annual reports on inadequate visualizations and illustrate misleading patterns along with improved versions.

4.2 Design of the Artifact

With its characteristics, the BIV Assistant provides guidance to users on how BIV guidelines have to be applied. Therefore, we draw on the integrated taxonomy of guidance design features proposed by Morana *et al.* (2017) to assure a comprehensive design of the artifact.

This taxonomy characterizes the dimensions audience, target, mode, directivity, invocation, timing, intention, content, format, and trust-building (Morana *et al.*, 2017).

SSBI is intended to be used by any employee who has to conduct business analyses and design business reports, no matter their expertise. Therefore, we primarily focus on BIV novices as *audience*, since they appear more likely to need assistance.

To increase the perceived ease of use, the *target* of the BIV Assistant is to facilitate to comply with BIV guidelines, which can be seen as engaging in a given activity (Morana *et al.*, 2017). In our case, the BIV guidelines are determined by the IBCS (see above). Hence, as *mode* of assistance we draw on a predefined framework. Since the task to comply with these guidelines can be complex, the BIV Assistant *directs* the user to adhere to the IBCS, which may result in a perceived ease of use of complying with BIV guidelines. UAS ought to reduce users' mental working memory and should not additionally burden the user with interruptions at the wrong time (Gregor and Benbasat, 1999). Hence, a user-triggered *invocation* and retrospective *timing* is chosen. Since the BIV Assistant does not con-

stantly interrupt the multi-staged BIV process (Ware, 2012), users remain in their thought process and receive assistance upon request.

To increase the perceived usefulness of complying with BIV guidelines, the BIV Assistant shows warning messages and thus informs what elements of the visualization can lead to a distorted perception (e.g., avoid truncated axes (Hichert and Faisst, 2015)). The *intention* of the warning is twofold. First, it is used to clarify why a specific inappropriately visualized element is misleading. Second, it provides working explanations and expert knowledge (i.e., terminological *content*), drawing on the know-how from the IBCS. The presentation *format* of these warnings is a combination of text and image. For the textual description of the misleading element, the BIV Assistant displays explanations provided by the IBCS. Since textual descriptions may have some limitations in terms of comprehension (Kuechler and Vaishnavi, 2006) and bear language barriers (Morana *et al.*, 2017), we complement the warning with an image of the improved business chart.

Trust in assistance, such as receiving guidance on why and how to comply with BIV guidelines, can have a strong effect on users' intention to follow suggestions (Morana *et al.*, 2017). Therefore, we intend to proactively *build trust* and hence increase reporting related self-efficacy by applying guidelines from the IBCS, which describe how to assure appropriate BIV.

In summary, the design aspects, which may lead to an increased perceived ease of use and perceived usefulness of complying with BIV guidelines as well as increased reporting self-efficacy may help to foster the intention to comply with BIV guidelines.

5 Experimental Evaluation

5.1 Evaluation Design, Participants and Procedure

To evaluate the artifact's performance, it should be evaluated against its research objectives (Peffers *et al.*, 2007). With this study, we aim to suggest an experimental design that helps to gain insight to what extent UAS affect the intention to comply with BIV guidelines, in particular in an SSBI environment. In addition, we performed a preliminary study to investigate whether the suggested design works. To determine the evaluation method, we refer to Venable *et al.* (2012). We chose a laboratory experiment, since the artifact already has been developed (i.e., ex post evaluation) and since an artificial evaluation environment provides the benefit of controlling for possibly confounding variables as well as allows measuring the efficacy of an artifact. More precisely, we chose a within-subject design for this experiment, where participants may experience report design both with and without using a UAS for BIV. Although within-subject designs are susceptible to possible learning effects (Charness *et al.*, 2012), we decided to follow such a design, since potential learning effects are of minor relevance when investigating the effects of UAS on intention to comply with BIV guidelines. Moreover, a within-subject experiment requires less participants compared to between-subject designs (Lazar *et al.*, 2010), which can be a relevant aspect for conducting a preliminary study. Since studies indicate that managers and students behave similarly (Bolton *et al.*, 2012), 14 university students (4 female, 10 male, average age: 22) of an IS course participated in this preliminary study.

To analyze the relationship between using a UAS for BIV (i.e., independent variable) and the intention to comply with BIV guidelines (i.e., dependent variable), we differentiate between two measurement settings. In both settings, participants have the task to identify inadequate BIV in four different business charts according to the IBCS guidelines. The settings of the measurements differ in the type of assistance, however. Since BIV guidelines are typically provided in written documents (e.g., Few (2012), Ware (2012), Hichert and Faisst (2015)), the only assistance allowed in the first setting were the IBCS guidelines, which are published via the website of the IBCS Association. In the second setting, participants could use our BIV Assistant to fulfil the requested task.

The experiment was structured in multiple stages (cf. Figure 1). First, participants were introduced to the experiment and got a short training on how to access the BIV guidelines of the IBCS Association website. In the next step, they had to accomplish the above described task according to the first setting.

After its completion, they were asked to answer multiple questions on their intention to comply with BIV guidelines. For this, questionnaires with validated items from prior research (Venkatesh and Davis, 2000) were translated into German and adapted to IBCS guidelines. For example, "Assuming I have access to the system, I intend to use it" was adapted to "Assuming I have access to the IBCS guidelines, I intend to use them." Due to the constructs of interest, the questions from Venkatesh and Davis (2000) comprised items for measuring the intention to use, which in our case is the intention to comply with BIV guidelines (ITC), perceived usefulness (PU), and perceived ease of use (PEOU). For measuring self-efficacy (SE), we draw on items from Spannagel and Bescherer (2009), who focus on scales of computer user SE. All items were measured on a 7-point scale, where 1 = strongly disagree and 7 = strongly agree.

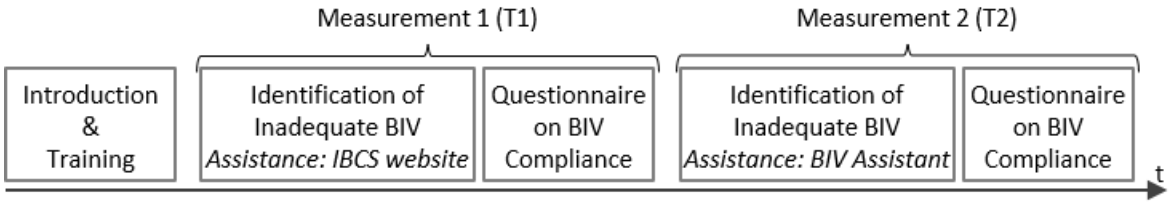

Figure 1. Design of the Within-Subject Experiment

To reduce potential learning effects for the second measurement, we slightly modified the business charts with inadequate BIV and changed the sequential order for the second setting. Here, participants had to fulfil the described task with the opportunity to use our BIV Assistant. To assess constructs related to intention to comply with BIV, the same questions as in the first setting were used.

5.2 Results of the Preliminary Study

Venkatesh and Davis (2000) as well as Spannagel and Bescherer (2009) show a high reliability (i.e., Cronbach's α) of their measurement scales. However, as we slightly adopted and translated these items, we computed the reliability of our scales to assure an appropriate basis for our analysis using SPSS version 24. The results of this reliability analysis are satisfactory and depicted in Table 2.

Next, we analyzed whether the intention to comply with BIV guidelines as well as its antecedents can be enhanced by the usage of our BIV Assistant. As we used a within-subject design, we conducted dependent t-tests and compared the differences between means of the variables under the conditions at measurement 1 (T1) and measurement 2 (T2). Any significant difference observed indicates an effect of using our BIV Assistant. The result of this analysis shows that means of all variables increased from T1 to T2. In particular, the increase in report SE was highly significant, and increases in PEOU as well as in PU were marginally significant. However, although there was also an increase in ITC, it was not significant. Hence, while not finding support for H1, we found support for hypotheses H2-4. The results of this analysis are presented in Table 2.

		Cronbach's α		Dependent t-test				
Scale	n	T1	T2	Mean at T1	Mean at T2	p	H	Legend
ITC	14	0.96	0.69	5.32	5.71	0.290	(H1)	(*) marginally significant (p < 0.10)
PU	14	0.86	0.87	4.82	5.50	0.052 (*)	(H2)	* significant (p < 0.05)
PEOU	14	0.81	0.94	4.64	5.62	0.061 (*)	(H3)	** highly significant (p < 0.01)
SE	14	0.84	0.85	4.36	5.14	0.002 **	(H4)	

Table 2. Reliability of Scales and Dependent T-Test Results

To examine if the propositions from TAM hold in the context of BIV guideline compliance, we conducted a multiple linear regression analysis to compute the influence of the independent variables PU, PEOU, and SE on the dependent variable ITC. Measurements were used from T2, as we intended to see whether the propositions from TAM hold after using our artifact. The R^2 for the overall model was .90 (adjusted R^2=.88) which indicates a high goodness-of-fit according to Cohen (1988). PEOU, PU, and SE were able to statistically significant predict ITC, with $F(3,10)=32.2$, $p<.001$. However, regression coefficients differ in their ability to predict ITC. While PEOU significantly predicts ITC ($\beta=.70$, $p<.05$), PU was not significant ($\beta=.30$, $p=.19$), which is also the case for SE ($\beta=-.02$, $p=.86$). Hence, while finding support for H6, this is not true for H5 and H7. These findings indicate, that in a BIV context, PEOU is especially important to foster ITC. These outcomes are depicted in Figure 2.

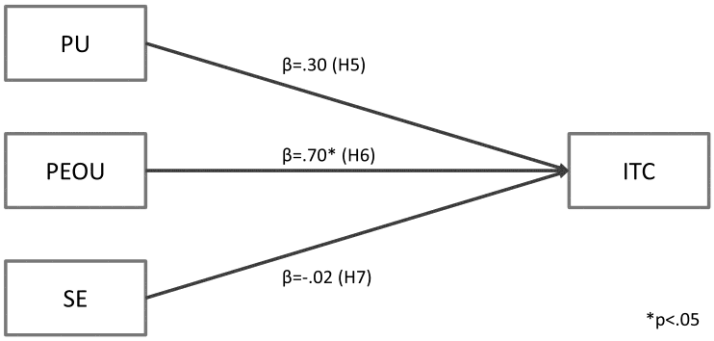

Figure 2. Regression Analysis of Antecedents of ITC

These first results show that using the BIV Assistant may lead to increased perceived ease of complying with BIV guidelines, perceived usefulness of complying with BIV guidelines, and report-related self-efficacy. In addition, they indicate that perceived ease of complying with BIV guidelines appears to be the most important antecedent of intention to comply with BIV guidelines. In the following, we provide a conclusion on these findings and outline possibilities for future research.

6 Conclusion and Future Research

Following the DSR activities proposed by Peffers *et al.* (2007), we showed that using UAS may impact compliance in a BIV context. Since we could not identify studies that examine whether UAS may affect the intention to comply with BIV guidelines based on our literature review, we proposed a design of a UAS that aims to improve this intention and introduced the BIV Assistant as a prototypical implementation. According to Briggs and Schwabe (2011), this is a DSR contribution of the applied science and engineering category, since we provide an instance of a generalizable solution in form of a proof-of-concept prototype. The second DSR contribution provided by this study is experimental research, which leads to hypotheses, experimental designs, and analyzed data sets (Briggs and Schwabe, 2011). Based on a within-subject experiment, we provide indications that the BIV Assistant has a positive impact on complying with BIV guidelines. In addition, the findings indicate that in a BIV context, perceived ease of use of complying with BIV guidelines is especially important to foster the intention to comply with guidelines.

Of course, this study only draws on data from a small preliminary study. However, based on the statistically significant findings provided by this study, we aim to substantiate our results in a next design cycle as proposed by Hevner (2007), using the proposed evaluation design. For this purpose, we intend to further develop the existing prototype to reflect a higher number of BIV guidelines, and seek to also evaluate it among actual decision makers in organizations.

Moreover, we also aim to analyze to what extent UAS and their design features can help to train BIV guidelines, since self-efficacy may also be influenced by the degree of a user's knowledge on how to appropriately design reports. With our BIV Assistant, we hope to provide a novel and fruitful avenue for improving BIV in SSBI and thus decisions based on the resulting reports.

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NUDGING FLEXIBILITY – INCREASING ELECTRIC VEHICLE USER'S CHARGING FLEXIBILITY WITH DIGITAL NUDGES

Extended Abstract

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Abstract

Smart charging systems can prevent problems with the integration of battery electric vehicles (BEV) and allow the user to optimize the charging process according to his preferences. To do this, however, the user must enter his flexibility into the smart charging system. We propose that this flexibility can be increased by the means of choice architecture and digital nudging. Setting defaults and presentation of normative defaults can successfully encourage end users to conserve electric energy. We propose an online experiment to investigate the transferability of these nudges to the provision of charging flexibility.

Keywords: Digital Nudging, Green IS, Load Shifting, Electric Mobility.

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1 Introduction

Uncontrolled charging of BEVs can cause high loads and thus require expensive peak generation technologies and cause grid congestion. The smart charging offers a solution for this. It controls the charging process according to various optimization goals (e.g., cost- or emission-minimizing), depending on the users' preferences. However, this only works if the user is willing to provide his flexibility (i.e., not charging immediately). To do this, the user must make a decision about his flexibility potential and enter it into the smart charging system. Many BEV users are willing to provide flexibility to avoid grid bottlenecks or to integrate more renewable energies [Will and Schuller 2016].

Users do not always make the best decisions because humans often rely on heuristics that can lead to biases [Tversky and Kahneman 1974], for example, when they do not use their charging flexibility to save money or protect the environment. [Thaler and Sunstein 2008] propose to intervene in such cases by choice architecture (i.e., a careful design of the decision environment). Digital nudging is the application of this principle on information systems [Weinmann et al. 2016].

(Digital) Nudges have been successfully used to motivate users to conserve water [Nayar 2017] and electricity [Loock et al. 2013, Schultz et al. 2007] or to choose electricity from renewable energy sources [Momsen and Stoerk 2014]. In particular, the setting of defaults and references to the positive behavior of other users have proven to be successful.

Since charging flexibility will be needed to successfully integrate BEV into the energy system, the question arises whether nudges can increase the charging flexibility provided by BEV users. We start by researching whether default setting and normative defaults transfer to the provision of charging flexibility and therefore investigate the following hypotheses.

Hypothesis 1: *Providing a default nudge indicating high charging flexibility in an IS for charging management of BEVs increases the charging flexibility provided by the BEV user.*

Hypothesis 2: *Providing a social nudge indicating high charging flexibility of peers in an IS for charging management of BEVs increases the charging flexibility provided by the BEV user.*

Hypothesis 3: *Providing a social default nudge indicating high charging flexibility of peers in an IS for charging management of BEVs increases the charging flexibility provided by the BEV user.*

2 Methodology

In the first step, we want to test the hypotheses in an online experiment that reflects the incentives. In the experiment, the user can decide whether to use his hypothetical charging flexibility to avoid CO_2 emissions or to save charging costs by shifting the charging towards times with low emission factors or low electricity prices. In the second step, the user can enter his charging flexibility into the mock-up of the user interface of a smart charging system. The experiment will therefore feature a 2x4-between-subject design with two optimization targets (CO_2 and monetary) and four nudges implemented into the design of the user interface mock-up. The control treatment is a neutral interface, where the user can enter his flexibility. For the hypothesis, the user interfaces pre-selects a default for flexibility provision (H1, H3) or provides information on the flexibility provided by peers (H2, H3).

The CO_2 or monetary savings based on the flexibility provided in the experiment are linked to a payout. The flexibility provision is penalized with a penalty that occurs with a low probability and depends on the amount of flexibility provided. This is to ensure that the online experiment maps the real world situation, where the provision of flexibility could lead to a situation where the BEV is needed but not fully charged.

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